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JULY, 1924

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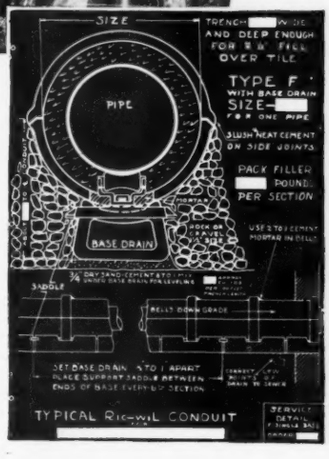
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SLUSH NEAT CEMENT ON SIDE JOINTS
PACK FILLER POUNDED PER SECTION
PIPE
BASE DRAIN
ROCK OR GRAVEL FILL
USE STIFF CEMENT MORTAR IN BELL
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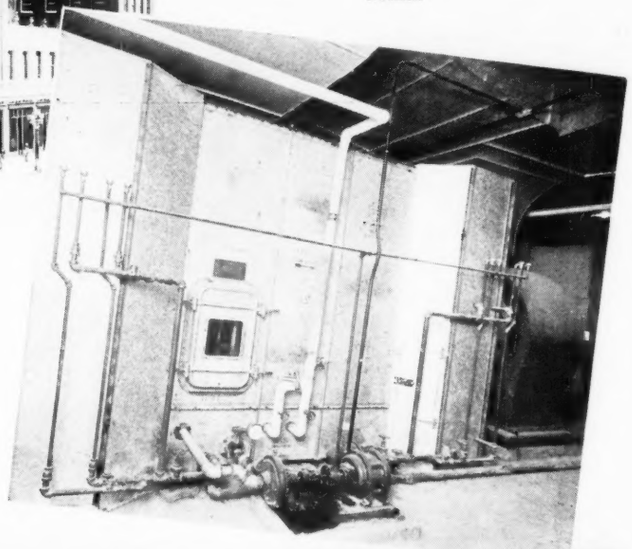

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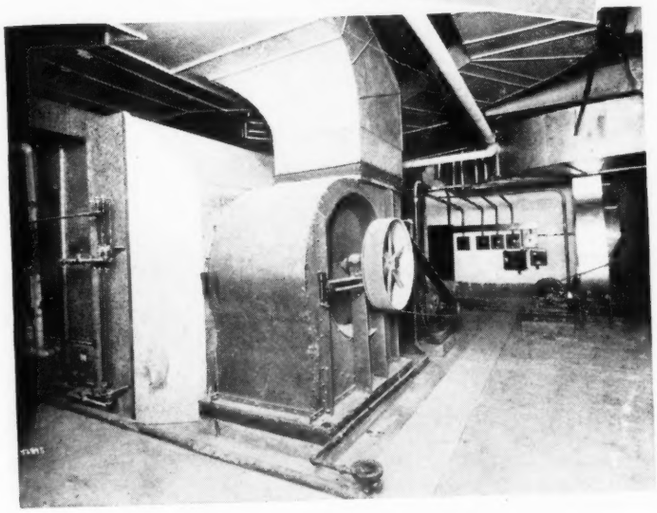

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JULY, 1924

Cold Storage for Furs and Fabrics

The Requirements to Be Met in Overcoming the Ravages of Moth Millers and Beetles, with Notes on Successful Practice in the Design of Cooling Apparatus for Cold-Storage Rooms

By H. J. Macintire

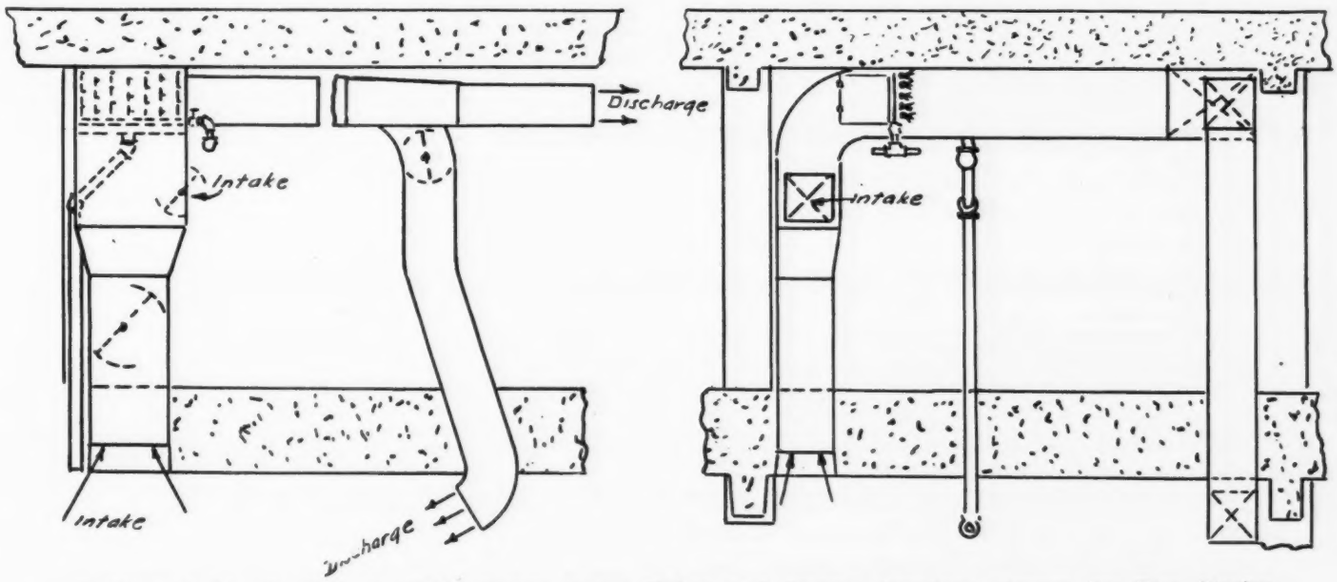
Associate Professor of Refrigeration, University of Illinois.

BECAUSE of the damage due to the ravages of moths and beetles the fur storage industry has developed to quite an extent during the summer months. Storage at freezing temperatures also tends to improve the lustre of the fur so that the fur has an improved lustre and, therefore, a better appearance after the warm weather is over and the furs are needed again in the fall or the early winter.

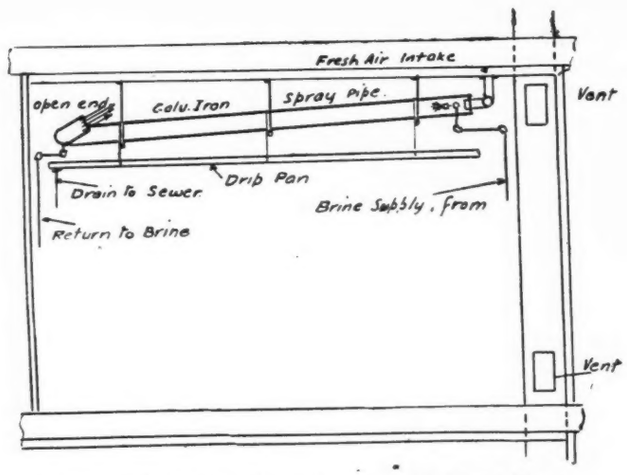
TEMPERATURE REQUIRED BY MOTHS AND BEETLE BUGS

The moth and the beetle egg require a temperature of 55° F. for hatching. If hatching occurs the insect eats the fur to secure the grease and the animal juices existing there and the fur constitutes the chief food of the insect and supplies the necessary material for the cocoon of the moth. If the larvae are hatched the movement becomes active at 45° F. and above, and the fur will be injured; this activity increasing up to 55° F. where normal activity is reached. Temperatures below 45° F. stunt the activity to a point where little or no damage is done, and at 42° it has been demonstrated that although the insect may be still moving, yet it is very sluggish and at 40° F. all movement is suspended.

The *moth miller* and the *beetle* are killed at a temperature of 40° F., but relatively slowly, whereas at 32° F. they are killed quickly. If they are rolled up in rugs or garments they may be protected for weeks, but the evidence is that no damage is



Cooling of Air By Use of Brine Sprays Using Tubes and Ducts—Overhead Sprays for Two Stories.



Spray Brine Cooling for Small Head-Room.

done under the conditions of 32° to 40° F. In fur or rug storage it is better to hang up the garment and to lay the rug out in flat piles, and the temperature must be 40° or lower. The larvae may survive a temperature of 18° F. for weeks, but usually it may be killed if the temperature is permitted to rise to 45° to 50° for a day or two and then lowered again. As a rule, 25° is the usually preferred operating temperature.

CONSTRUCTION FEATURES OF FUR-STORAGE ROOMS

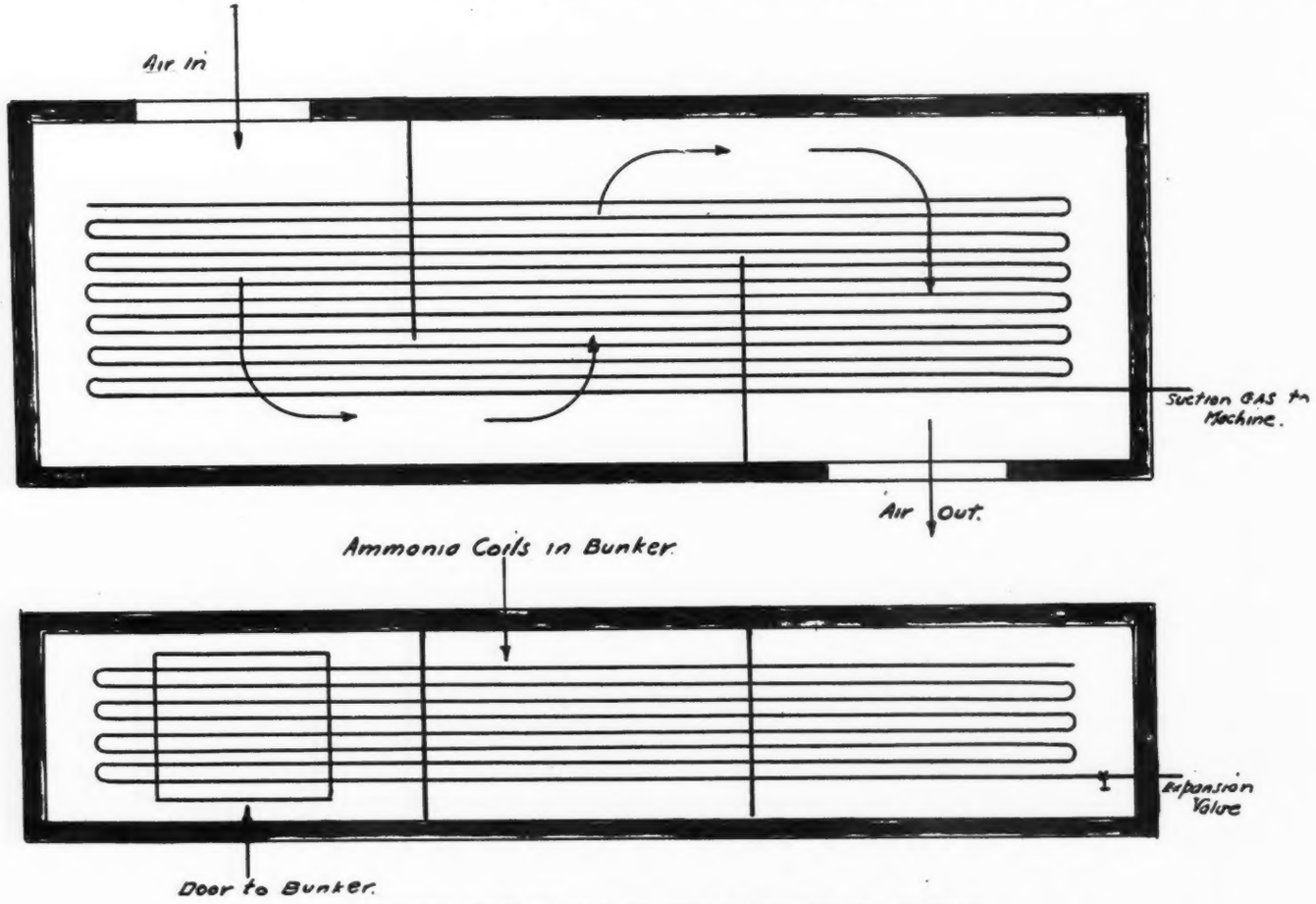
The fur storage room is not opened to much of any extent, after the goods are placed in storage, until after the summer is over and the refrigeration required is nearly all "heat leakage." Such storage rooms require no windows of any sort and, in consequence, no correction has to be made for window infiltration or leakage. Electric lights are used, of course, but the amount of heat generated by their use is very small, after the goods are once stored. Only one door is usually provided and that is of the usual cold storage construction and is usually tight and of the same insulating value as that of the rest of the room. The insulation is usually of 5 to 6 in. cork board, erected in thicknesses of 2 in., with the joints broken and put up in cement mortar or asphalt. A ½-in. cement mortar finish is given the inside of the walls and the ceiling.

PRECAUTIONS TO TAKE WHEN PIPING IS USED

In providing refrigeration, piping in the rooms is almost never used, except, perhaps, in the very small rooms. If piping is used it should be very carefully protected so that the frostation on the pipes could never drip on to the goods. There is a danger also from the pipes should leaks occur, either from the brine or from the ammonia, as the case may be. It is not known whether carbon dioxide is innocuous to furs and fabrics, but the understanding is that no appreciable harm occurs.

THE BUNKER ROOM METHOD

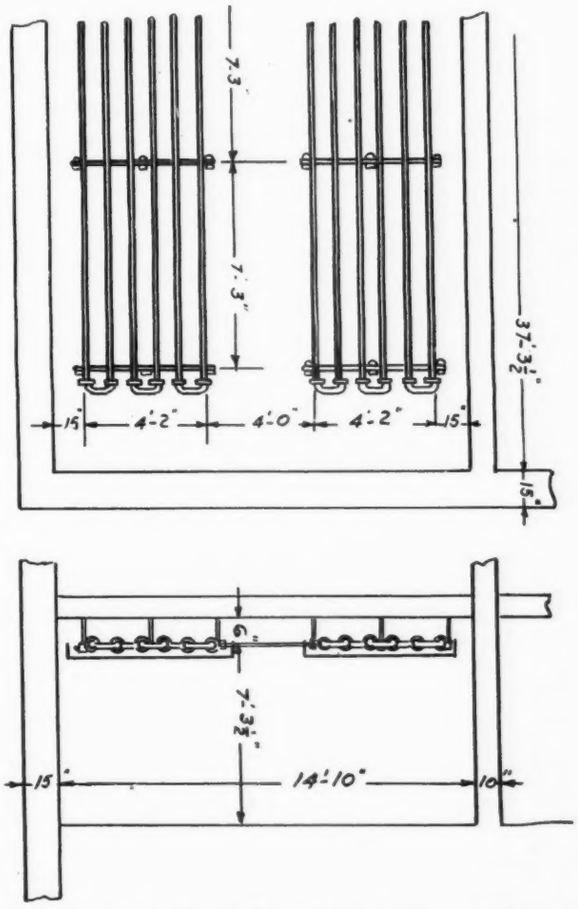
The preferred method of cooling is by the use of a bunker room. With small rooms, the air may be admitted in one or two places, but the larger rooms need distributing ducts for the supply and the re-



Bunker Coils Located on Side of Room or in Anteroom.

turn. Such ducts, of course, may be designed for velocities as high as 2100 ft. per minute, but, as a rule, lower velocities are used—from 1200 to 1600 ft. being usual.

Refrigeration is different from heating and ventilation as regards the use of fans. The fan not only uses power to drive the air, but the heat equivalent of the work done must be neutralized by the use of the refrigeration machine. Excess power supplied then is a double expense in the case of refrigerating plants and, in fact, there is required a 1/5 ton of refrigeration for every horse power supplied to the fan.



Arrangement of Direct-Expansion Piping, Using Drip Pans Under Pipes.

DATA ON BUNKER ROOM DESIGN

The bunker is usually designed (as in the case of the chocolate-dipping spray chamber) for 500 ft. per minute air velocity and the bunker is usually arranged for three passes of the air. In some of the constructions the baffles are used to catch the condensate and guide it to the waste pipe. Where the size of the plant warrants it, there is no reason why the brine-spray chamber cannot be used, with eliminators, as in the case of the cooling of air. In fact, there are now on the market small spray cabinets which would meet any requirement. As air infiltration is very small, and the commodities do not dry out as do vegetables, fruits and meats, there will be little moisture condensed and, therefore, very little trouble from diluting of the brine.

The illustration shows a simple pipe-coil bunker-room for ammonia. Ammonia piping is now designed for little or no return bends or other fittings. Instead, the pipes are bent and the separate pipes are welded—usually by the electric method. A number of such pipes are welded together (as many as can be handled without difficulty during erection) and similar units are joined together by means of the usual tongue-and-groove fianges. Or sometimes the job is made up at the point of erection by the use of thermit welding of different coils, and, in this manner, a complete welded system of piping is obtained.

REFRIGERATION LOAD ALMOST ENTIRELY A LEAKAGE LOAD

From the foregoing it is evident that the refrigerating load is a small one. It is almost entirely a leakage load, and, therefore, it depends on the insulation provided. With 5 or 6-in. corkboard, the volume of space per ton of refrigeration is about 3000 cu. ft. But this is a case where the load can be calculated with great precision, taking the maximum sustained temperature usual in the locality where the installation is to go, and designing the plant for not more than 12 hours' operation, thereby giving a factor of safety if more severe conditions prevail.

Selecting Wall Stacks Scientifically for Gravity Warm-Air Heating Systems

By V. S. Day

(From a paper presented at the recent midsummer meeting of the American Society of Heating and Ventilating Engineers.)

The feature of this paper was two curves, based upon the experimental work conducted for the National Warm Air Heating and Ventilating Association at the University of Illinois. One was designed to be easily and effectively applied in the selection of wall stack sizes and the other to show the velocities of flow actually obtaining in the stacks of gravity warm-air furnace installations.

After the heating requirements for the room are calculated and the register temperature predetermined, the curves in Fig. 1 show the cross sectional area of the stack which will convey the required amount of heated air at the proper register air temperature. Conversely, if the stack size is predetermined, the heating effect available may be read from the curve, or, again, if the size of the stack is fixed and the heating requirements known, the necessary register air temperature may be read from the curves.

For example, a room having a calculated heating requirement of 10,000 B. T. U. per hour may be heated at 170° F. at the register, by a stack 45 sq.

in. in area. If a register air temperature of 150° F. is used, the stack must be 65 sq. in. in area, or, if the stack may not exceed 35 sq. in. in area, the register temperature must be 188° F. Thus, a given heating effect may be delivered in large pipe at a low register temperature, and in a small pipe at a high register temperature.

From the foregoing will be seen the importance of knowing the considerations affecting the selection of register air temperature, because the register temperature selected as a basis for design must not be so low as to require very large and impracticable pipe sizes, nor so high as to give high discharge velocity with its accompanying high ceiling temperatures.

Professor Day presented a chart (Fig. 2) showing the velocities of flow actually obtaining in the stacks of gravity warm-air furnace installations. The chart shows the relation between register air temperature, stack cross-sectional area, and mean velocity of flow in the stacks.

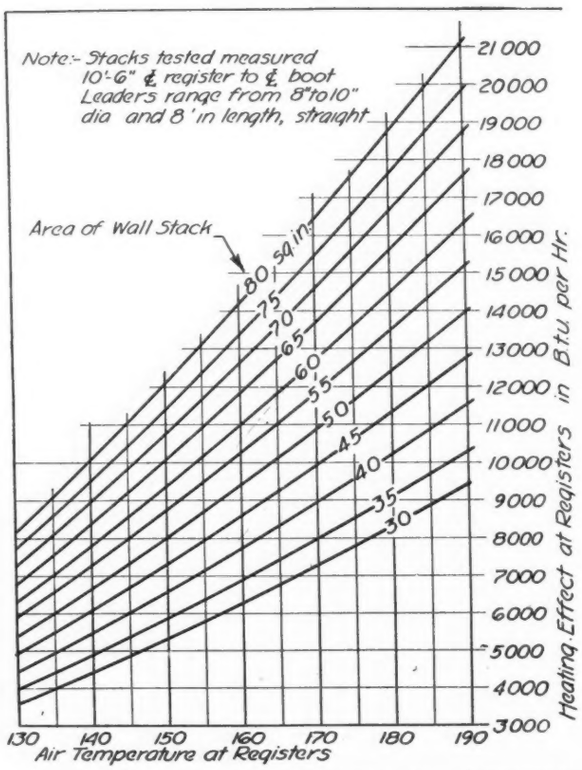


Fig. 1—Relation Between Register Air Temperature, Stack Area and Heating Effect at Register.

With Fig. 2 the actual amount of the changes in velocity occurring in stacks due to changes in temperature may be determined. In the foregoing example, a register air temperature of 170° F. and a stack 45 sq. in. in area were mentioned. Fig. 2 shows the velocity to be 381 ft. per minute. If, as before, the temperature was changed to 150°, the stack area would become 65 sq. in. and Fig. 2 shows the new velocity in the stack to be 295 ft. per minute. Thus, it is evident that reducing the register air temperature 20° would bring about a reduction in velocity of 86 ft. per minute, or 23%.

As Professor Day showed, both size and velocity are fundamentally dependent upon register air temperature which, he said, must, therefore, be the basis of design in gravity warm-air heating design.

Professor Day's paper included a formula for figuring the volume of air required to make good the heat losses from the room:

$$V = \frac{10\,H}{A \times d_r \times (t_r - 70)} = \text{velocity in ft. per minute.}$$

in which H = heating requirements of room, in B.T.U. per hour.
A = area of stack in square inches.
d_r = density of the warm air.
$(t_r - 70)$ = difference in temperature between register and normal room temperature.

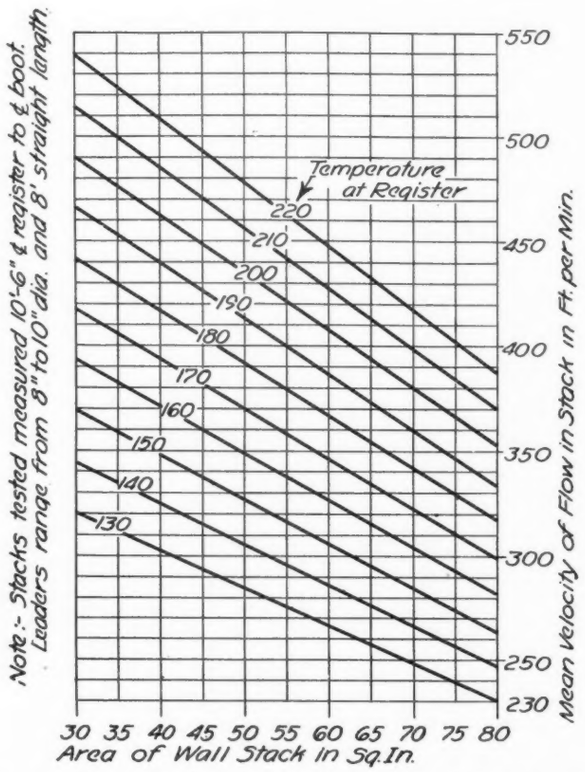


Fig. 2—Relation Between Stack Area, Mean Velocity of Flow in Stack, and Register Air Temperature.

This expression gives values of flow at the register slightly lower than the mean velocity of flow in the stack, the difference being on the side of safety.

The application is as follows: If, as before, the heat requirement H is 10,000 B.T.U. per hour, and register temperature 170° and the stack area 35 sq. in., the velocity is

$$\frac{10 \times 10{,}000}{35 \times 0.0610 \times 100} = 470 \text{ ft. per minute.}$$

(*Continued on page* 52)

How to Figure the Resistance of Pipe Bends to the Flow of Steam

With Data on Four Assumed Conditions, Using Standard Ells, Long-Radius Ells, Minimum Radius Bends and Bends with a Radius of Ten Pipe Diameters

By Charles H. Day
Superintendent, Steam Heating Department, The Cleveland Electric Illuminating Company.

THE effect of bends and elbows in the average steam line may have serious results on the operation of the line. If the line is short and has but few changes of direction, these usually can be neglected. However, if the line is long and has several bends in it, or if the line is to carry low-pressure steam, the resistance of the turns has a very marked effect on the amount of steam that can be transmitted.

It is usually customary to allow for the resistance of elbows, but to neglect the resistance of bends. The accompanying curves are an attempt to arrive at the approximate resistance of pipe bends with different radii.

While there is considerable information available relative to the effect of elbows on the flow of steam, a recent inquiry disclosed little information on the resistance of pipe bends. In the accompanying article the author has taken the data at hand and adapted them to the new conditions.

THE FOSTER FORMULA

In a paper presented at the annual meeting of the American Society of Mechanical Engineers, in December, 1920, and entitled, "Effect of Fittings on Flow of Fluids Through Pipe Lines," Dean E. Foster arrives at a formula for the resistance to flow by fittings which is as follows:

$$L = 43.7\ r\ d^{1.2}$$

where L = number of straight pipe equivalent in resistance to a fitting.

r = a factor of resistance whose value depends upon the shape of the fitting.

d = the inside diameter of the pipe in feet.

For standard ells, Mr. Foster gives a value of $r = 0.67$ and, for long-radius ells, a value of $r = 0.33$.

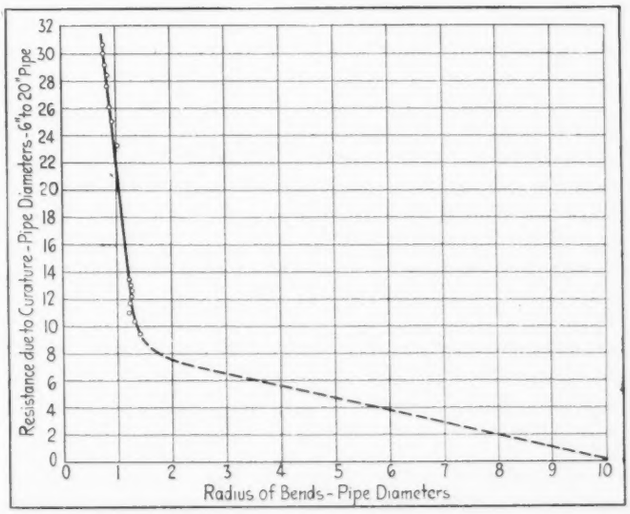


Fig. 1—Resistance due to Curvature Only. 6-in. to 20-in. Ells and Pipe Bends.

ASSUMPTIONS TO BE MADE IN APPLYING DATA

In order to apply these data to pipe bends of various radii, two assumptions are made:

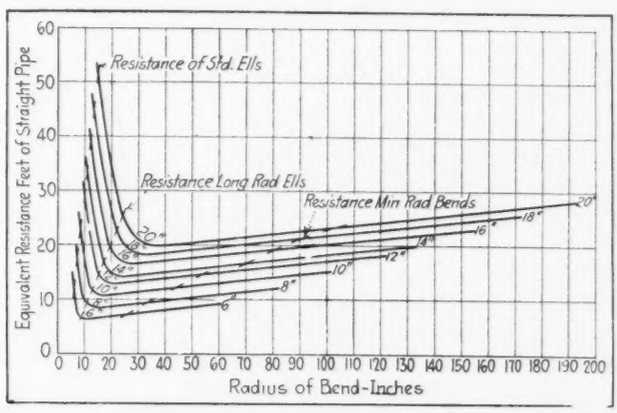


Fig. 2—Approximate Resistance of Elbows and Pipe Bends, 6-in. to 20-in.

1. That the resistance of a 90-degree elbow was made up of two parts (a) the resistance due to the length of the path through the fitting, and (b) the resistance due to the change of direction of the flow.

2. That the resistance due to the change of direction of the flow, which decreases materially as the radius of the fitting or bend increases, becomes zero or negligible when the radius of the bend is more than ten times the diameter of the pipe line.

HOW THE CURVES WERE PLOTTED

The solid-line part of the curve shown in Fig. 1 was plotted by first calculating the total resistance of 6-in. to 20-in. standard and long-radius ells by the above formula. From this resistance the length of the center line of the fitting was deducted. The quantity obtained represents the resistance due to the change of direction of the flow. This quantity, together with the radii of the various fittings, was

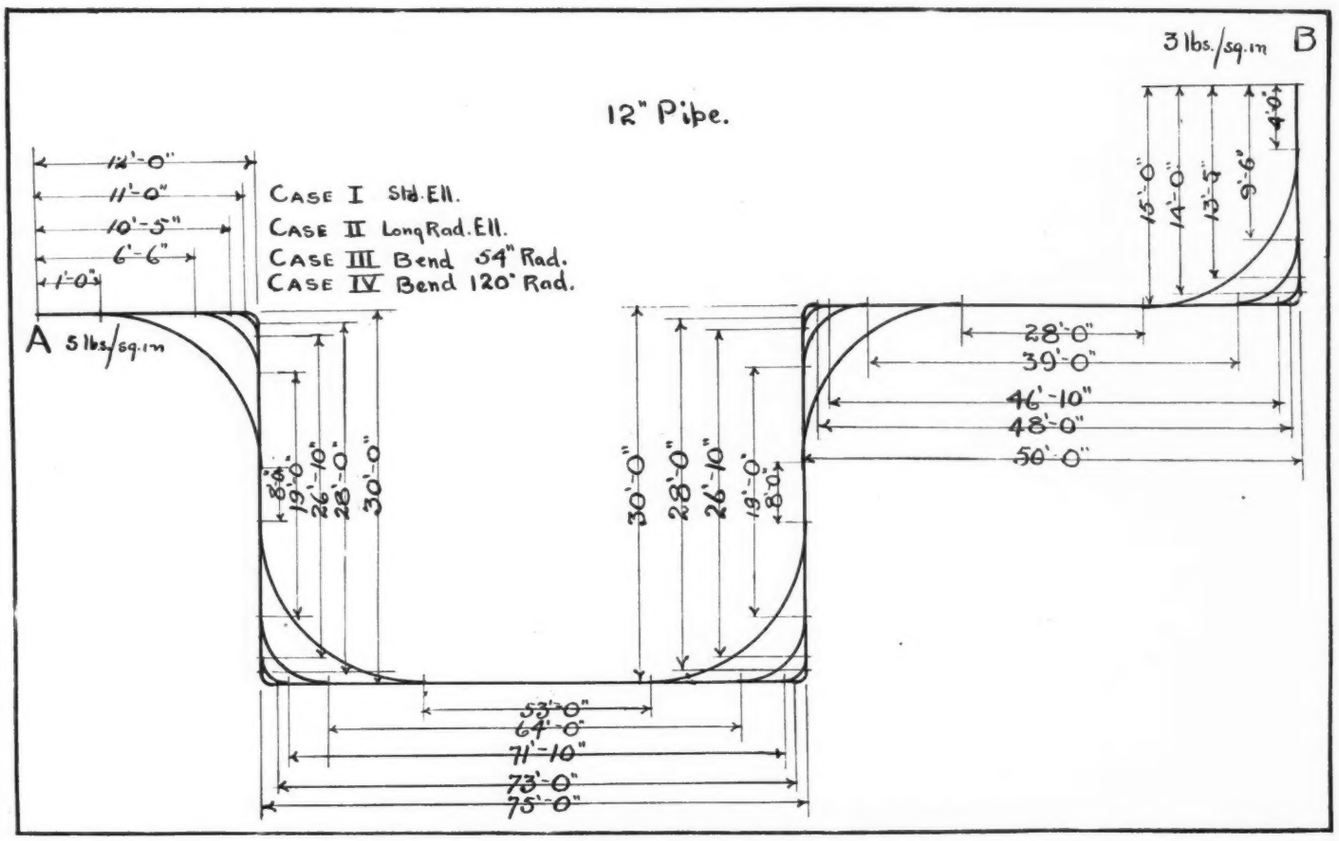


Fig. 3—Effect of Bends or Fittings in Four Typical Cases.

expressed in pipe diameters and the sixteen points shown on Fig. 1 obtained.

The curve was then projected to a point of zero resistance for a bend with a radius of ten pipe diameters, as shown by the dotted line in Fig. 1. Thus the curve shows an approximation of the relation between the radius of a fitting or pipe bend, and the resistance due to the change of direction of the flow.

The curves of Fig. 3 were then calculated by adding the length of flow path of the fitting or bend to the resistance due to change of direction and expressing the quantities in some workable units, namely, resistance of fittings in feet and radius of fittings in inches. For convenience, the resistance of standard ells, long-radius ells and minimum pipe bends are marked.

CALCULATION FOR FOUR TYPICAL CASES

To show the effect of bends or fittings on the 12-in. pipe line, shown in Fig. 3, four cases have been calculated (1) using standard ells, (2) using long-radius ells, (3) using minimum-radius bends and (4) using bends with a radius of 10 pipe diameters, or 120 in.

In each case it is assumed that the initial pressure at A is 5 lbs. and the final pressure at B, 3 lbs. By means of Unwin's formula the capacity of the line will be found to be as follows:

	Standard Ell.	Long-Radius Ell	Minimum Bend	10-Diameter Bend
Feet of straight pipe.....	202.0	196.2	157.0	102.0
Resistance of ells or bends.	145.0	72.5	72.5	90.0
Total resistance in feet....	347.0	268.7	229.5	192.0
Capacity of line, pounds per hour from 5 lbs. to 3 lbs..	3800	4345	4650	5110

Thus, by substituting a bend with a radius of 10 ft. for a standard ell, the capacity of the line shown in Fig. 3 can be increased approximately 34.5%.

Selecting Wall Stacks Scientifically for Gravity Warm-Air Heating Systems

(*Continued from Page* 49)

Reference to Fig. 2 will show that 405 is the velocity corresponding to 170° for this size stack and a change must be made as the velocity required exceeds the velocity obtainable. If the stack area is fixed the temperature must be increased. If 180° is assumed, the velocity calculated will be 430 which is in agreement with the value shown in Fig. 2 at 180°. On the other hand, if the register air temperature is fixed at 170° the stack size should be increased. If 45 sq. in. is assumed the velocity calculated will be 365 and Fig. 2 shows that the stack is capable of developing a velocity of 380 ft. per minute.

It is important to notice in Fig. 2 that higher velocities of flow may be obtained in small stacks at low temperatures than can be obtained in large stacks at much higher temperatures.

A Speedy and Accurate Method of Figuring Radiator Sizes

By P. R. Babcock

(All rights reserved)

With the method here described, the author has sized radiators in an 18-story office building, with a total of 393 radiators and about 190 separate rooms, in about 18 hours. This includes time taken to determine ceiling heights and sizes of windows and the making of the charts. The charts shown are the outcome of years of experience in figuring radiator sizes.

THE method here shown of determining the sizes of radiators has been found particularly valuable for large office or other building installations where there are numerous rooms with the same ceiling heights and same sizes of windows. On a fair-sized building, the method has saved many hours and sometimes days of tedious figuring. It is as accurate as you care to make it.

The chart itself is used as follows:

Assume a room 35 ft. x 20 ft. x 12 ft.

Outside temperature, 35° F.

Inside temperature to be 70° F.

Radiation required equals 40 sq. ft. x factor 1.143 (for 12-ft. ceiling height and 35° to 70° rise in room temperature) = 45.7 sq. ft. of radiation. This, of course, is for direct steam radiation and for two changes of air per hour. For other conditions, a factor can be obtained by the formula shown which will cover any limitations and be accurate.

Thus, if one wanted the number of square feet of water radiation necessary for the air in rooms,, with ceiling heights of 13 ft. 9 in., and 1½ changes of air per hour, and figuring to heat from zero to 65°, the average temperature of the radiators being 170° and the radiator transmission coefficient being 1.6 B. T. U. per degree difference per square foot per hour, we would have:

C. H. = 13.75 ft.

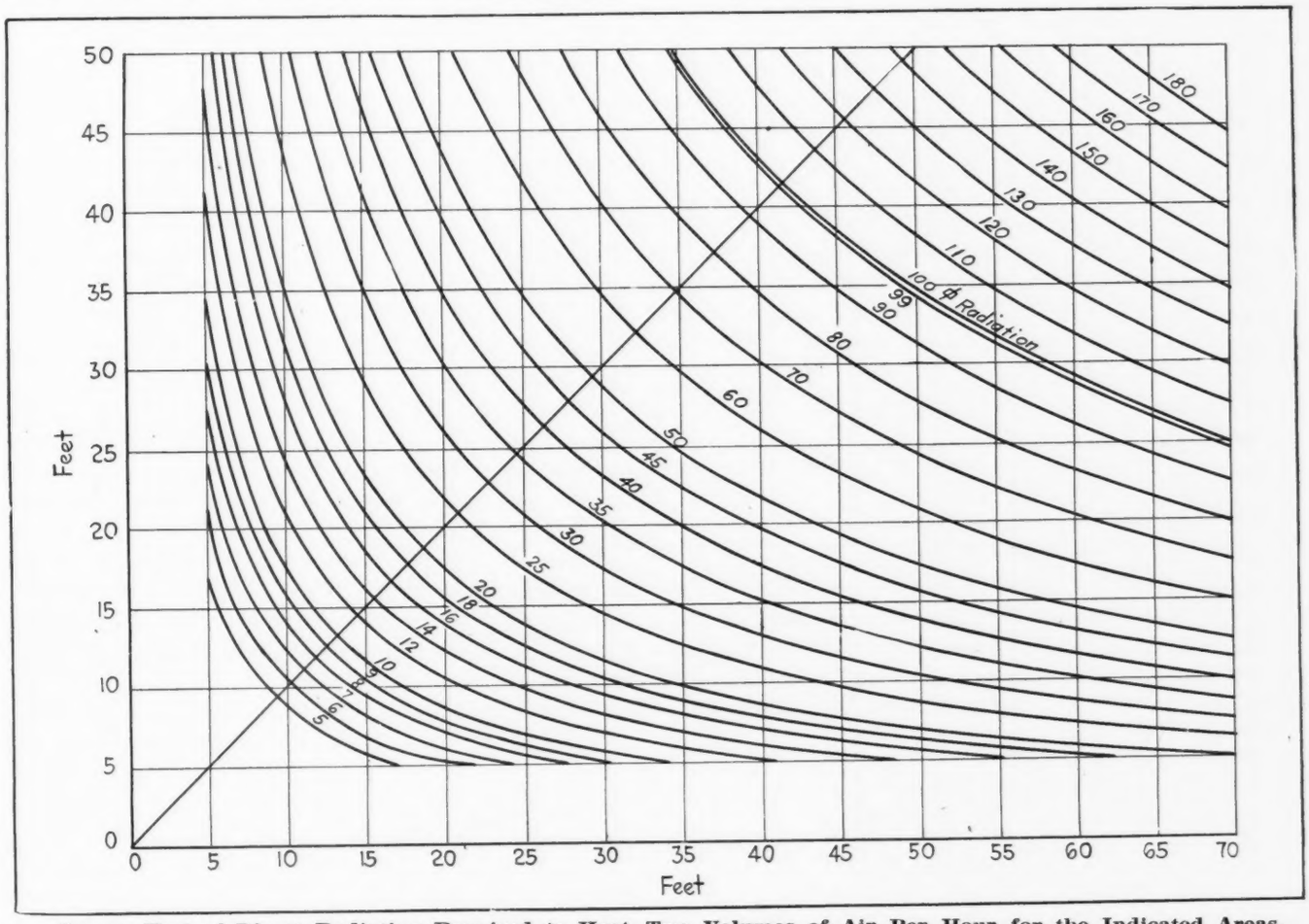
$C_R = 1.6$

$t_1 = 65°$ F.

$t_2 = 0°$ F.

$t_3 = 170°$ F.

$n = 1.5$.



Square Feet of Direct Radiation Required to Heat Two Volumes of Air Per Hour for the Indicated Areas, from 35° to 70° F., with a Ceiling Height of 10 Ft. 6 in. (Steam at 212° F. and Radiator Coefficient, 1.62)

Formula: $\frac{L \times W \times 10.5}{182}$ **= Square Feet of Radiation.**

MULTIPLICATION FACTORS				
C.H.	0° to 70°	30° to 70°	35° to 70°	40° to 70°
8'-0"	1.524	.872	.762	.653
8'-6"	1.620	.926	.810	.694
9'-0"	1.714	.980	.857	.735
9'-6"	1.810	1.035	.905	.775
10'-0"	1.904	1.089	.952	.816
10'-6"	2.000	1.144	1.000	.857
11'-0"	2.096	1.198	1.048	.898
11'-6"	2.190	1.253	1.095	.939
12'-0"	2.286	1.307	1.143	.980
12'-6"	2.380	1.362	1.190	1.020
13'-0"	2.477	1.416	1.238	1.061
13'-6"	2.572	1.471	1.286	1.102
14'-0"	2.666	1.525	1.333	1.143
15'-0"	2.856	1.634	1.428	1.225
16'-0"	3.048	1.743	1.524	1.306
18'-0"	3.428	1.961	1.714	1.469
20'-0"	3.810	2.179	1.905	1.633

Chart and above table based on $t_3 = 212°$ and $C_R = 1.62$ and $n = 2$. Factor formula=

$$\frac{[t_1 - t_2] \times C.H.}{35 \times 10.5}$$

Formula to find a factor for any condition:

$$\frac{182}{10.5} \times \frac{C.H. \times n \times (t_1 - t_2)}{55.2 \times C_R \times (t_3 - t_1)}$$

C. H. = ceiling height.
C_R = coefficient of radiator's transmission.
t_1 = inside temperature, deg. F.
t_2 = outside temperature, deg. F.
t_3 = temperature of heating medium, deg. F.
n = number of changes per hour.

The factor would be (as shown in the factor formula):

$$\frac{182 \times 13.75 \times 1.5 \times (65-0)}{10.5 \times 55.2 \times 1.6 \times (170-65)} = 2.50 \text{ plus.}$$

Therefore, a room 50 ft. x 20 ft. = 58 sq. ft. (from chart) × 2.5 = 145 sq. ft. of radiation required for the air in the above example.

A room 15 ft. x 15 ft. = 13 sq. ft. (from chart) x 2.5 (factor) = 32.5 sq. ft. of water radiation.

DRAWING A RADIATOR CHART

The chart for radiator requirements for the exposed walls and windows is easily made as follows:

Take a piece of cross-sectional paper and mark, as shown in Fig. 2, for feet of wall along the bottom, and square feet of radiation along the edge. Then figure two conditions: say, 6 ft. of exposed wall, including one window; and 20 ft. of exposed wall, including one window.

These two conditions should be figured as accurately as possible. On the particular chart shown (Fig. 2) 6 ft. of wall and one window = 5 sq. ft. of radiation. 20 ft. of wall and one window = 10.1 sq. ft. of radiation.

Draw a straight line through these two points.

Now 12 ft. of wall and two windows are twice 6 ft. and one window, or 10 sq. ft. of radiation; also 40 ft. and two windows = 20.2 sq. ft. of radiation (10.1 x 2).

Draw a straight line through these two points. It will be found that spaces between consecutive lines are always equal and the lines are parallel, so that it is a simple matter to make a complete chart.

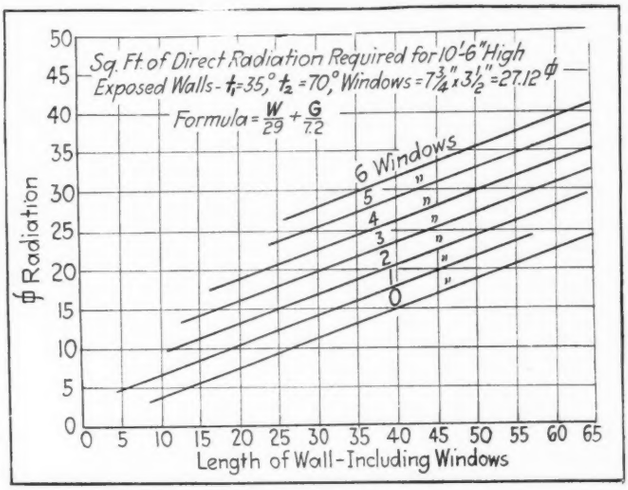

Sq. Ft. of Direct Radiation Required for 10'-6" High Exposed Walls - t_1=35°, t_2=70°, Windows = 1¾" x 3½" = 27.12 ϕ
Formula = W/29 + G/7.2
6 Windows
5 "
4 "
3 "
2 "
1 "
0 "
ϕ Radiation
Length of Wall - Including Windows
0 5 10 15 20 25 30 35 40 45 50 55 60 65
0 5 10 15 20 25 30 35 40 45 50

Fig. 2.—Typical Radiator Chart.

If the cross-sectional paper used is ⅛ in. and the drawings are drawn to ⅛-in. scale, one may read off the requirements directly from the drawings without using even a scale. Such a chart can easily be made in one-half hour.

Quartz Windows Proposed to Admit Sunlight to Buildings

(By Science Service)

Real sunshine indoors is the possibility held out by Dr. Edward R. Berry, assistant director of the Thomson Research Laboratory of the General Electric Company, as the result of the perfection of a process for making fused quartz. Glass windows, it is thought by many, keep out the healing and stimulating ultra-violet rays of sunshine. Quartz, or rock crystal, it is stated, lets them through; and if windows were made of quartz, people could enjoy indoors exactly the same sunshine they would get under the open sky. The results of Dr. Berry's researches were briefly announced at a recent meeting of the American Philosophical Society in Philadelphia.

Rock crystal has been known from ancient times, and that it can be fused has been known nearly 100 years, by Dr. Berry is the first to develop a practicable method, suitable for development into commercial applications although development in that direction has been limited so far. The trick is in the use of a special type of electric furnace for the melting of the quartz, in which the heat is furnished by the electrical resistance of a carbon cylinder, within which the graphite crucible is contained.

The Fixed Orifice Method of Temperature Control

Tests Showing the Practicability of This Arrangement as Used with Variable Pressures of Either Water or Steam

(From the report of the Heat Utilization Committee, National District Heating Association, presented at its annual convention in New York June 10-12, 1924)

AMONG the more recent heating systems easily adaptable to manual temperature control is the fixed orifice method. This method involves a minimum of manipulation, keeps steam in the radiation during complete time of building occupancy and maintains a uniform temperature in the building.

The principles of this method are not particularly new, but it is only recently that they were commercialized. It is a system which is so easily adaptable to central heat and which promises so much in the way of efficient temperature control, better circulation, reduced radiation temperature and return temperature, and of which so little is generally known that more than casual attention should be given to it. With this in mind, the following discussion was prepared. While not based on any actual experiences on large installations by the author, the data are the best available at the present time and indicate savings such as to at least warrant trial installations for more careful study.

METHOD THE REVERSE OF MODULATING VALVE METHOD

This method is exactly the reverse of the modulating valve method in that the orifice at the radiator is fixed but the pressure is varied to suit the heating requirements. The orifice is so proportioned as to pass only steam required to supply the building heat losses. Radiation is proportioned so that, when completely filled with steam at atmospheric pressure, it will be just sufficient in cold weather. The steam distribution system is designed to give very nearly equal pressures or, at least, known pressures at each radiation. Then by varying the pressures to correspond with the outside temperature, the radiators are heated fractionally to the extent that the heat emitted from the hot surface will equal the heat lost from the building.

RESULTS OF TYPICAL TESTS

During the past winter tests have been conducted with this method of temperature control. The radiators of several rooms were equipped with different types of orifices. The pressures at the radiators were adjusted to permit a steam flow just sufficient to heat the rooms to 70° F. Outside temperatures, inside temperatures, steam pressures, ahead of the orifices and weights of condensate were measured each half hour.

These tests were run mainly to determine the practical disadvantages rather than the quantitative savings effected. There are some disadvantages in that the system is not automatic and requires control by hand, thus making the human factor the principal variable in the steam consumption of the building.

On the other hand, there are a number of advantages. The principle is readily adaptable to an old system of any type with either steam or hot-water radiation. Rooms requiring more heat than others can be easily supplied with the correct amounts of steam by changing the size of the orifice. New systems of any type can be installed cheaply by merely replacing the ordinary radiator valve with one containing an orifice and properly proportioning the pipe sizes and orifices.

The operation is very simple and needs much less attention than most methods of hand temperature control. Pressures do not need adjusting more than two or three times during the day. In the morning, when steam is turned on, the pressure on the system is maintained at several pounds so as to heat up the building quickly. After the building has come up to temperature, it is set according to the outside temperature. It can remain at this pressure, with perhaps a slight readjustment to apply for wind and sunshine conditions, the balance of the day.

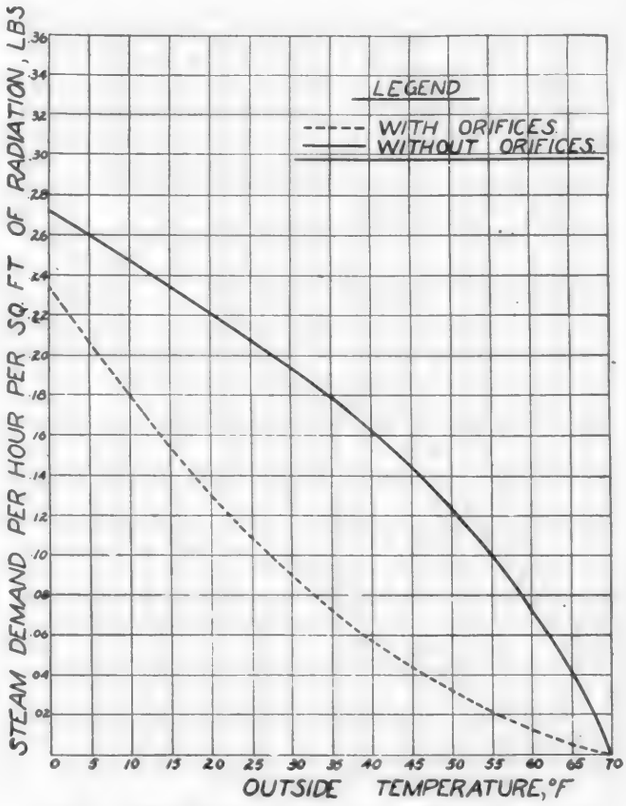


Fig. 1—Test Results With and Without Orifices

The initial and maintenance costs are low compared to most of the modern types of systems.

The results of the tests are shown in Fig. 1, in

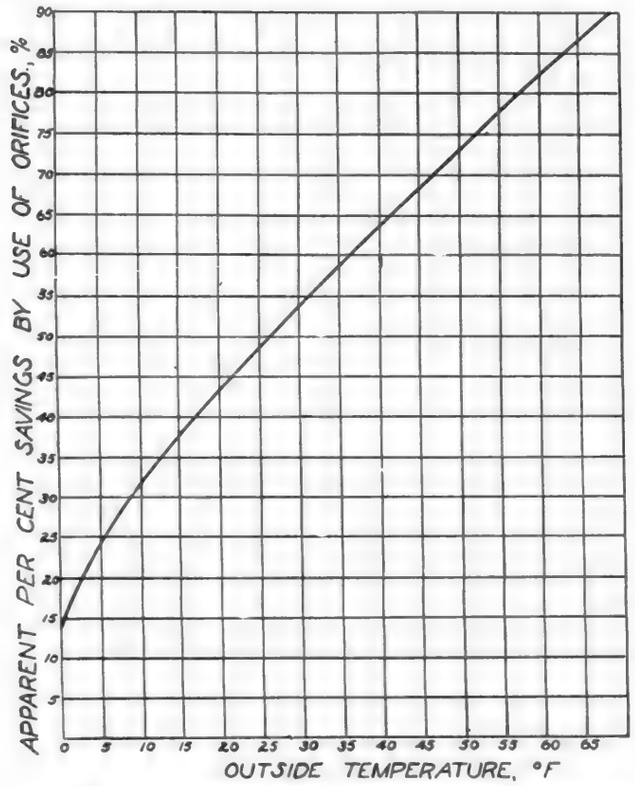


Fig. 2—How Outside Temperatures Affect Savings With Orifices

which the steam demand per hour per square foot of radiation is plotted against outside temperature. In the same figure are plotted similar data for an average of thirty buildings containing various other types of heating systems operating economically. You will notice very marked savings due to orifice control. The fact that these results are based upon square foot of radiation may not make the comparison exactly true. However, the savings are so great that even if they were cut in two they would still be worth while striving for.

The radiation of the rooms under test was figured by the method prescribed by the National District Heating Association and did not appear to be excessive in cold weather. Most of the other buildings used in the comparison were modern buildings in which the radiation was figured by competent heating engineers.

The fact that the steam demand at zero is nearly ¼ lb. per square foot per hour in both curves would also indicate that the radiation was fairly well proportioned to the heating requirements.

If the figures for radiation were high under the test conditions and low under actual conditions, which equal steam consumption per unit of heat loss, the steam consumptions would vary by a constant ratio under all outside temperature conditions. To show more clearly the very marked decrease in steam consumption in mild weather by the use of orifices, Fig. 2 was plotted.

RESULTS OF ANOTHER TEST

An actual installation of this type was installed on the office floor of one of the central heating plants in Detroit. The heating system for this office is a one-pipe, up-feed system serving only one floor and containing about 545 sq. ft. of direct radiation.

The usual reducing valve set up was removed and in its place throttle valve and orifice were installed. The pressure ahead of the orifice was maintained at just sufficient pressure to maintain a 70° building temperature. Aside from any saving which was effected by this installation, the increase in comfort of the building was very marked. The temperature seldom varied more than two degrees during the day with only about two or three settings of the throttle valve. The usual stuffy feeling of the air was entirely eliminated.

During the period of test, records were kept of the steam consumption, inside and outside temperatures, and outside pressure. Later, the original system was again put in service and similar records kept.

During the latter period exactly as much attention was paid to the heating system as before. Windows were kept closed most of the time. The temperature would become excessive, however, before the occupants were aware of it at times and

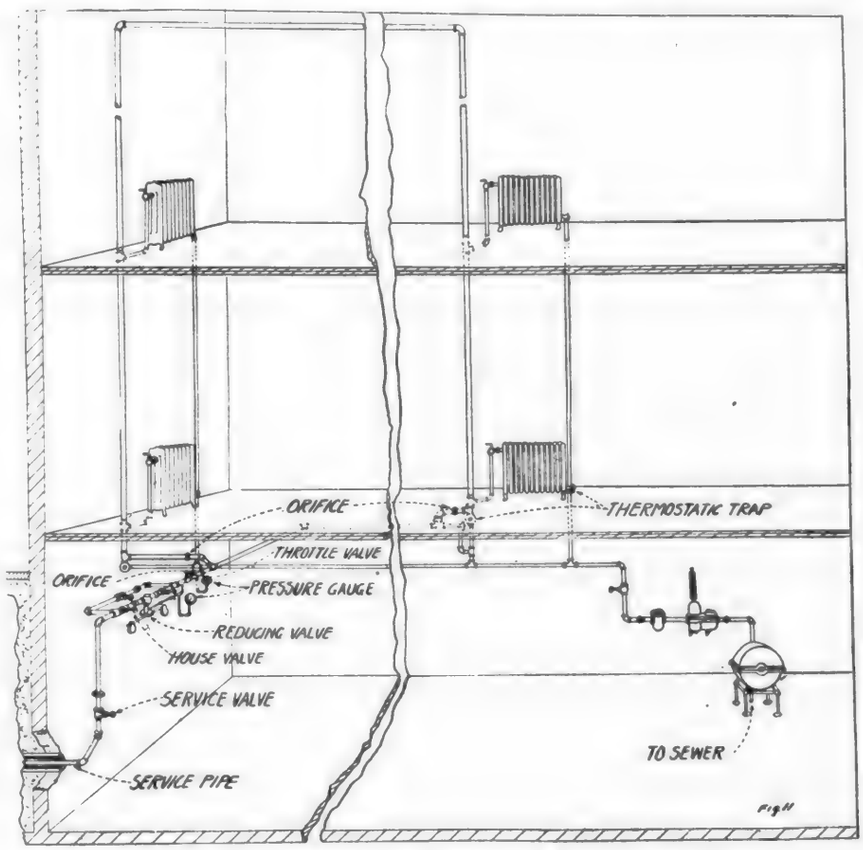


Fig. 3—How Orifices Are Used in A Typical Heating System

the windows were opened to cool the room quickly. The author remembers but once that this condition was necessary with the use of orifices.

The steam consumption during the period with the orifice in the system was 55 lbs. per day per degree difference in temperature, while with the straight steam system this unit consumption was 83 lbs., indicating a saving of 34%.

PREVIOUS INSTALLATIONS OF THE FIXED ORIFICE METHOD

This type of heating system is not new; it has been used successfully in several installations which have been brought to the author's attention. Perhaps the first system of this type was a group of church buildings costing approximately $180,000.00 and intended to be as complete as modern art and science could produce. The system proposed was a dual system of steam and hot water. The hot water to be used in mild weather and the steam in cold weather. The excessive cost of this system seeming unjustified the final system was designed for steam using fixed orifices and variable steam pressure.

The National Cathedral at Washington, D. C., embodied the same principle with excellent results. This system was designed by Professor S. Homer Woodbridge and has operated successfully since 1920.

Professor Woodbridge has published a very complete and detailed description on the design and construction of these systems in THE HEATING AND VENTILATING MAGAZINE for December, 1920, and January, 1921, and the methods of design will not be duplicated in this article. Professor Woodbridge further writes, "In my own application of the principle, I have almost invariably used, as a precautionary measure, a thermostatic trap in connection with each radiator or convector with steam fed through an orifice, though if orifices are properly proportioned and steam pressure is properly and reliably regulated, the necessity for use of the trap does not exist.

"The principle of the orifice is applicable to cases requiring a lower temperature in one room and a higher temperature in another room, in both of which rooms the radiators are of the same size, and exposures of the rooms are identical, as in private wards in hospitals where a cool room is needed for the medical treatment of one case, and a warmer room is wanted for medical treatment in another room. When, however, the orifice area is fixed by the 'set' of a modulating valve, such a situation may be successfully met by a temporary change in the 'set' of the valve of the radiator from which more or less heat is desired.

"So far as I chance to know, the largest application of the method and my data, published in some issue of THE HEATING AND VENTILATING MAGAZINE, has been made by the Canadian Domestic Engineering Company, Montreal, the company reporting complete success and large savings in employing the method principally for the purpose of equalizing the distribution of either steam or water in heating systems. That, however, is but one, and a minor, function of the orifice.

"I am interested to learn that Mr. Hubbard, my head draftsman for some twelve years, has entered the field of the orifice."

Mr. Hubbard has described the system in the Washington Cathedral in the HEATING AND VENTILATING MAGAZINE for April and May, 1920.

APPLICATION OF METERING BUSHINGS USING THE "FIXED ORIFICE" PRINCIPLE

The systems thus far mentioned usually use hot-water radiation. Where steam radiation is used a special bushing has been devised which contains an orifice and which directs the steam in the first section of the radiator. These so-called "metering bushings" are described in THE HEATING AND VENTILATING MAGAZINE for December, 1923. Several installations with these bushings have been installed in Minnesota. The Metering Bushing Sales Company has sent records on some of these buildings (given in the complete paper).

CONNECTING UP SYSTEMS WITH ORIFICES

Small Installations.—The small systems with orifices are similar to the regular vapor system with the exception that immediately after the reducing valve loop a throttle valve and orifice are installed. This orifice is so proportioned as to pass only steam required to supply the building heat losses in severe weather with maximum initial pressure. The pressure drop to the radiator is proportioned to be nearly equal in each case and orifice valves are installed in each radiator so as to supply proper steam quantities. The reducing valve is set for a definite constant maximum pressure and the actual pressure adjustments are made by setting the throttle valve. For convenience the stem on the throttle valve is extended through the first floor and a graduated dial will assist in its setting to correspond to the temperature indicated on the thermometers.

Large Installations.—Large installations of this type are shown in Fig. 3. They are similar to the smaller except that to facilitate the proper distribution the main is kept at a relatively high pressure controlled by the main throttle valve and orifice. Pressures are kept constant in the risers by installing orifices at the foot of each riser. The steam to each radiator is controlled through orifices in the radiator valves.

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IT IS very evident that a critical situation has been reached in what may well be termed the "radiation rules jam," in which the interests most directly affected are the Heating and Piping Contractors' National Association and the American Society of Heating and Ventilating Engineers. This situation is that at the present time the heating contractors have published, under the title of "Engineering Standards," rules for figuring radiation as compiled by their Committee on Standardization, while the American Society of Heating and Ventilating Engineers has issued, in tentative form, the third revised draft of its proposed "Code of Minimum Requirements for the Heating and Ventilating of Buildings," both of which deal with the same general subject but in different ways. Some such rules have been found especially desirable by the heating contractors for the reason that more and more are they being called upon to guarantee to all purchasers of radiation that the radiation figured is the correct amount to be provided in a given building.

We recall very distinctly that long before work was started on either code the representatives of the heating contractors requested the heating engineers to undertake the preparation of a standard code for testing heating systems. When the society did not respond to this request, the next move was that the heating contractors put the matter up to their Standardization Committee which evolved the present "Engineering Standards."

It was after the publication of "Engineering Standards" by the heating contractors that the American Society of Heating and Ventilating Engineers issued its first draft of the proposed "Code of Minimum Requirements for the Heating and Ventilation of Buildings," the third section of which contains "Minimum Requirements for Estimating the Heat Required for Warming Buildings." This section, prepared by a sub-committee headed by Professor A. C. Willard is, in itself, a masterful piece of work, considerably more comprehensive than "Engineering Standards" and, as stated, differing from those rules in method, rather than in the results they give. In fact, as Professor Willard has stated, in discussing the two codes, the results obtained by them differ by only four-tenths of 1%.

That, however, is not the question immediately at issue. It is plain that if two standard codes are established for figuring radiation, while both may be entirely correct, they can never have the authority and standing that would be accorded a single code. The importance of this should be emphasized because the whole object of the heating contractors is to obtain a uniform method of figuring radiation which will have the approval of all those to whom the courts might look for technical information on the proper methods and the proper quantities for figuring radiation. It is the simple truth, as the heating contractors state, that "if we, through our Committee on Standardization, develop one method of figuring radiation, the American Society of Heating and Ventilating Engineers another, the National District Heating Association another, and the manufacturers another, as far as the courts are concerned, none of these would have the proper standing."

Very naturally, the heating engineers feel that if any such standards are to be established, they are the ones to do it, and the point has been made that this is the first time an organization of contractors has essayed to fix engineering standards.

Fortunately, as we believe, the proposed code of the heating engineers was not finally adopted at their semi-annual meeting in Kansas City last month. This, at least, affords a breathing spell and will permit of a conference between the two associations, as was proposed at that meeting. In the meantime, the heating contractors have gone on record in a resolution which invites the various interests affected into conference "with the idea of having the representatives selected by them act as sponsors, in connection with this (the heating contractors') association, for developing and adopting of uniform rules and methods for the calculation and design of heating systems."

It is going to require some cool and clear-headed handling to develop the proper atmosphere for bringing together the two principal interests involved. If we could just forget the matter of precedence and consider what the object is in the undertaking itself, we believe it would be possible to iron out the differing viewpoints. Certainly that is the sensible thing to do, and no one man's or one committee's views should be permitted to stand in the way. It has become a matter now for the governing bodies of each organization.

American Society of Heating and Ventilating Engineers

Plans Formulated at Semi-Annual Meeting to Continue Research Laboratory as Strictly a Society Proposition—Final Action Deferred on Proposed Heating and Ventilating Code

Kansas City, Kansas City,
'Bode of women fair and witty,
Home of men who shed good cheer,
We your guests are glad we're here.

Happy are we that our ways
Are cast with yours for these few days,
Now host and hostess, ere we go,
Our gratitude we'd have you know.

From now whene'er we speak your name
We'll spread your hospitable fame,
As host you've nobly played your part;
We know you are our country's "Heart."

MARTIN A. ROONEY, *at the Heating Engineers' Dinner in Kansas City.*

KANSAS CITY proved its right to the title of "The Heart of America" when it acted as host of the American Society of Heating and Ventilating Engineers meeting, June 10-12. Long before the first visitor arrived, plans had been whipped into shape by the local committee, under the direction of John H. Kitchen, providing for every detail of both the professional and entertainment programs and to say that the meeting proceeded without a hitch gives but a faint idea of the thoroughness with which the Kansas City members did their part. There was an unmistakable note of hospitality which was in evidence on every hand. Finally, the weather itself proved most propitious so that the outings which were scheduled between sessions were carried out under glorious skies and delightfully-tempered breezes.

Interest in the society's proceedings centered in the announcement by Chairman William H. Driscoll of the Committee on Research that plans are well advanced for the continuation of the society's Research Laboratory on an altered basis. A proposed amendment to the society's by-laws has already been drafted providing for an increase in the membership dues of $10.00. As the society has some 2000 members this will provide a revenue of $20,000. This will leave $10,000 still to be raised as the Research Laboratory budget has been fixed at $30,000 as a minimum. It is proposed to secure this difference through an increase in the rates for space in the society's *Guide*. The proposed amendment will be made effective, if adopted, beginning January 1, 1925.

The other major item of the convention was the consideration of the proposed Code of Minimum Requirements for the Heating and Ventilation of Buildings. Two full sessions were given over to the code and while the sections discussed were ordered "received" by the meeting, action regarding the adoption of the code was deferred to the next annual meeting of the society in January.

Opening Session, June 10

President Homer Addams called the meeting to order in the ballroom of the Hotel Muehlebach, Tuesday morning. After the welcoming remarks of Mr. Cannon, representing the mayor, Mr. Addams responded, calling attention to the splendid progress made by the society so far this year, both in the matter of membership and in the accomplishments of its committees. He spoke especially of the work done by the Code Committee, declaring that its successful completion will lead the nations of the world to look to America for guidance in matters pertaining to the practice of heating and ventilation. He also spoke of the success which has attended the publication of the *Journal* on a monthly basis. The next issue of the society's *Guide*, he said, will be published in a 10,000 edition.

Chairman Charles V. Haynes of the Committee on Increase in Membership presented figures showing the total membership of the society to be 1788. Of these 144 have been elected since the beginning of the year. Considering the applications now on hand, it was safe to predict a membership of over 2000 within a short time.

Referring to the *Guide* for 1924, Mr. Haynes said that its success was already assured. The new volume, it is expected, will contain 180 pages of manufacturers' announcements, representing a total revenue of $18,000.

The first paper of the meeting was presented by E. K. Campbell on "Using By-Products in Flour Mill Heating and Humidifying."

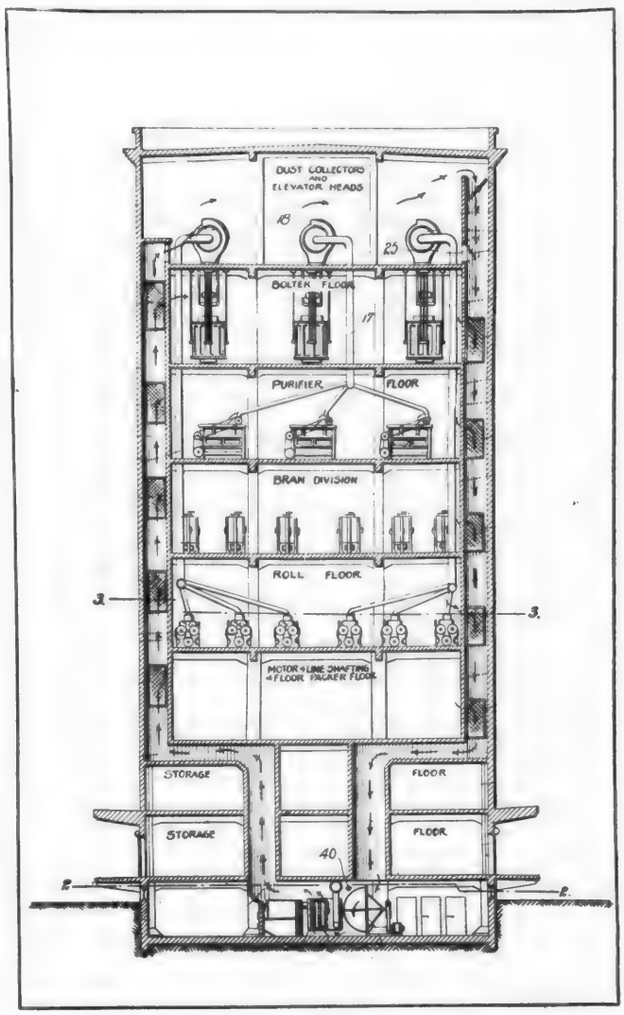
Using By-Products in Flour Mill Heating and Humidifying

By E. K. Campbell

In this paper Mr. Campbell gave some interesting data on a problem out of the ordinary run, that of utilizing the by-product heat and moisture in a flour mill. The excess heat is generated in the grinding process. Along with this heat is a large

amount of moisture thrown off from the grinders as a result of treating the grain with water. The soaking of the wheat is done to keep the fine particles from flying, which would mean loss of flour and an increase of the dust problem.

The installation described was made in a 6000-barrel flour mill in North Kansas City. At the present time, however, the equipment has a capacity of only 3000 barrels. The mill is an eight-story building, 240 ft. long by 65 ft. wide, and contains about 1,500,000 cu. ft. of space, of which 850,000 cu. ft. are heated. The estimated heat loss for the heated portion is about 3,000,000 B. T. U. per hour. The construction is of reinforced concrete and the current for the electrically-driven machinery is brought in from the outside, as there is no power-generating plant provided.



Sectional View of Building and Heating Equipment.

REQUIREMENTS TO BE MET

The requirements were as follows:

1. It is necessary to heat the third floor of the mill to 60° F. and all floors above the third floor to 70° whether the machinery is in operation or not, no heat at all being provided for the first and second floors.

2. It is necessary to humidify the mill while in operation and provide approximately 65% humidity summer and winter.

3. It is necessary to ventilate the mill in the summer while operating, to get rid of the surplus heat from the grinding process.

4. The owners desire to use this by-product heat and moisture which bothers them in the summer, to heat and humidify the mill when it is in operation in the winter.

FURNACE BLAST SYSTEM ADOPTED

After a study of the problem a furnace-blast system was adopted for the following reasons:

1. If the waste heat was really to be saved a sectional plant in which the individual units could be quickly stopped or started was essential.

2. Since the mill is buying its power from outside, it needed the most economical heat generators —and steam boilers are not so economical as rightly built hot-air furnaces.

3. Large volumes of air must be moved both for summer ventilating and to save the waste heat in the winter.

It was necessary first of all to heat the mill to 70° F. in the coldest weather. On the basis of 70° at —10°, the heat loss of the mill is about 3,000,000 B. T. U. per hour. To supply this loss four large furnaces of a type particularly adapted for industrial work were installed. The air is moved over these furnaces by two 8-ft. Parker-Hope fans which have blades in the shape of a half-globe. The two fans, which are each belted to a 10-H.P. motor, deliver about 100,000 cu. ft. of air per minute.

The duct system is laid out on the recirculating plan and although the main room on each floor is 111 ft. long, with both the supply and return openings at the same end, there is no difficulty in getting an even distribution of heat.

Four Industrial Heating Furnaces of This Type Were Used in Kansas City Flour Mill.

This installation is designed to heat the mill to 70° in the coldest weather in that section, without the aid of the by-product heat. It is also figured to heat the mill to 120° when it is 90° outside. This is important because it is necessary at times to raise the temperature to the point stated to destroy the pests and eggs which are brought in with the wheat.

HOW THE HUMIDIFICATION PROBLEM WAS HANDLED

One of the requirements laid down by the mill people was a method of heating 700 gal. of water per hour for treating the grain. This moisture is later evaporated and is carried by the air of the conveyor system to the eighth floor. With this amount of moisture it is quite evident that the humidification problem will take care of itself so long as this moisture is recirculated by the heating system. There is therefore no humidifying problem when both the mill and the heating plant are in operation.

Trouble, however, was found on the eighth floor where condensation occurred on the 8-in. concrete walls. It is planned to insulate these walls during the coming summer. In spite of this condition, two of the four furnaces, together with the by-product heat, heated the mill when it was —15° outside.

CONDITIONS WHEN THE MILL IS NOT IN OPERATION

When the mill is not in operation there is, of course, a humidifying problem because it is necessary to maintain the proper percentage of humidity to protect the stock, as well as to keep the air in proper condition for the workmen. Also, when the mill is in operation in summer, and the heated air from the dust collectors carrying its moisture is discharged from the mill, there is a humidifying problem. New air, of course, will be drawn into the mill continually and this air must be humidified to maintain 60% relative humidity in the mill.

To supply this humidity spray heads were installed in the rising column of air, using compressed air for atomization.

GENERATION OF HEAT BY GRINDING MACHINES AN INDEFINITE QUANTITY

No definite data are available as to the amount of heat generated in the grinding of a bushel of grain. It appears that the quantity is not the same any two times. It varies with the quality of the grain, with its preparation and with the condition of the air in the building.

In this particular mill, there are 30 Niagara cloth-tube dust collectors which discharge the air into the seventh and eighth floors. Although not 100% efficient, no air washers or other means of cleaning the air in connection with the heating system have been found necessary.

The ventilating problem in the summer is accomplished purely by the volume of cooler air driven into the mill. In the roof above the eighth floor are large ventilator openings under control. They are closed in winter but are wide open in summer, so that the hottest air of the mill is driven by the fans out through these ventilator openings. Air can be taken into the basement from any side of the building so as to obtain the coolest air possible. The fans operate all night in summer, as well as all day, which helps greatly in keeping down the temperature.

An interesting point in connection with the duct design is the carrying of the return-air duct full size clear to the ceiling of the eighth floor, instead of reducing it at each floor. This is due to the fact that the hottest air in the mill is next to the roof.

ECONOMY OF SYSTEM

Without any fire in the furnaces the by-product heat maintained a temperature of 70° when it was 40° outside, actually supplying three-eighths of the total requirements, or about 1,250,000 B. T. U. per hour.

As a whole the experiment has justified itself. It has paid its way and when carried to final conclusion under the best operating conditions, will prove a real method of saving fuel for the millers and so far there seems to be no obstacle which cannot be successfully and fully overcome.

Edwin S. Hallett endorsed the practice of recirculating air and emphasized the point made by Mr. Campbell that humidity is the problem in all air recirculating work. Referring to Mr. Campbell's comments on ozone, Mr. Hallett declared its principal usefulness was in removing odors in schools and similar buildings and that in flour mill installations he could easily see why it did not need to be considered.

Another paper presented at this session was by A. P. Kratz of the University of Illinois on "Performance of a Warm-Air Furnace with Anthracite and Bituminous Coal."

Performance of a Warm-Air Furnace with Anthracite and Bituminous Coal

By A. P. Kratz

The tests reported by Professor Kratz were supplementary to those previously reported in connection with the warm-air furnace heating research work at the Engineering Experiment Station of the University of Illinois. The same general arrangement of testing equipment was used, consisting, in this particular case, of a cast-iron circular-radiator type of warm-air furnace erected under a three-story steel structure in the Mechanical Engineering Laboratory. This structure served as the working skeleton of a house, and carried the stacks and registers for the various floors. A two-piece unslotted pot was used for all tests on anthracite coal, and a one-piece slotted pot for the tests on bituminous coal. For one of these tests the slots were sealed with fire-clay.

Two objects were sought in the tests, one, to compare the performance of the same furnace

operating with anthracite and bituminous coal, and, second, to determine the effect of the use of a slotted firepot on the operation with bituminous coal.

Performance curves for the furnace fired with two types of coal indicate that:

1—Within practical combustion rates the anthracite coal gave higher efficiency and capacity (based on rise in the temperature of the air from inlet to bonnet) than the bituminous coal for the same combustion rate. At combustion rates that are excessive for warm-air furnace practice, however, the reverse was true.

2—In the case of the bituminous coal, the efficiency was more nearly constant over the whole range of combustion rates than it was for the anthracite coal.

3—At a given combustion rate, more draft between the ashpit and smoke outlet was required to operate the furnace on anthracite coal than on bituminous coal.

4—With bituminous coal, as fired under the conditions of the tests, the slotted firepot gave about 9% greater efficiency and capacity than the firepot with the slots sealed.

An interesting fact brought out in connection with the temperature of the heating surfaces was that the firepot temperatures increase with an increase in combustion rate for anthracite coal, while the reverse is true for bituminous coal. This decrease in temperature indicates that the higher drafts required to produce the higher combustion rates cause an increase in the amount of air drawn through the slots, and result in cooling the firepot. The temperature of the firepot was uniformly lower for the bituminous coal than for the anthracite coal. The firepot temperature was also materially lower for the slotted firepot than for the one with the slots sealed. Accumulations of soot in the radiator in the bituminous coal tests amounted to about 1½ lbs. at low combustion rates and were negligible at high rates.

The discussion brought out the fact that no firing period had been established for warm-air furnaces as yet. H. M. Hart suggested that curves be developed for warm-air furnace performance at various efficiencies. The question of furnace temperatures was also discussed, especially when burning fuel-oil. Mr. Campbell stated that he had found 1200° F. to be the limit.

Afternoon Session, June 10.

An important paper presented at the opening of the afternoon session was C. V. Frost's compilation of the data on dry-return proportions which had been presented in January by Professor L. S. O'Bannon.

Determining Dry-Return Proportions

By R. V. Frost

Mr. Frost performed a greatly-appreciated service in taking the experimental data obtained by Professor L. S. O'Bannon, on the simultaneous flow of air and water in pipes, reported at the last annual meeting of the society, and analyzing the various factors to show, in a practical way, how they must be taken into account in properly proportioning dry-return pipes. The chart shown in Fig. 1 is the complete O'Bannon chart for simultaneous flow of water and air in 1-in. pipe, graded 1 in. in 10 ft., while the chart shown in Fig. 2 is that section of the O'Bannon chart that covers the field of practical application.

Instead of giving capacities for water flow in pounds of water per hour, Fig. 2 shows corresponding values in square feet of radiation. Thus, the 100-lb. line on the O'Bannon chart is the 400-sq. ft. of radiation line in Fig. 2.

Since each vertical line in Fig. 1 represents the carrying capacity of the pipe for a certain depth of flow at a given grade, it has been possible to establish corresponding carrying capacities for the same depth of flow at other grades; as shown by the values set opposite the grades of 1 in. in 20 ft., 1 in 30 and *vertical*. In this particular, however, it must be remembered that the O'Bannon experiments have not been completed, and consequently, other grade conditions than 1 in. in 10 ft. must be based on calculation from data of other authorities.

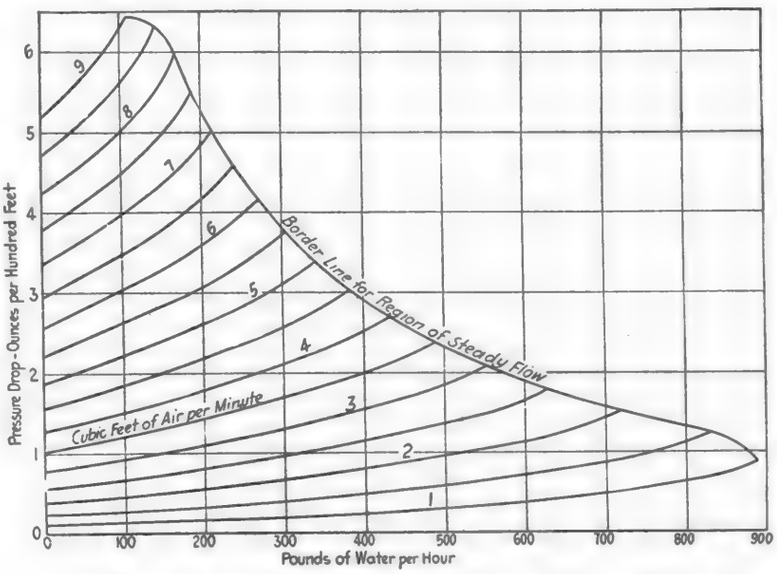


Fig. 1—Capacity Chart for Simultaneous Flow of Water and Air in 1-in. Pipe, Parallel Flow.

On the vertical side of Fig. 2, in addition to the pressure drop for 100 ft. of length, corresponding pressure drops for multiple lengths of 100 ft. have been shown.

In working out the capacities and resistances in return pipes from these charts it has been neces-

sary to establish certain basic values; the first, being the steam space volume in a direct radiator. This volume, without checking by actual measurement, has been calculated at 3 cu. ft. per 100 sq. ft. of radiation. Having established this value and setting some time limit for the ejection of air from the radiator, it is a simple problem to determine the relationship between capacity and pressure drop, or back pressure.

For example: If the air in a 400 sq. ft. radiator is ejected in 10 min., the rate of ejection will be 1.2 cu. ft. of air per minute, this point being plotted on the chart as shown.

In a similar manner, other points are plotted until the set of curves marked as the "Pressure Drop —Capacity Lines," have been established. By means of these curves, it is easy to read the pressure drop in the line or the back pressure, or pressure resistance,—as may be the preferred term, for any given relationship of capacity, time allowance for air ejection, and size and grade of pipe.

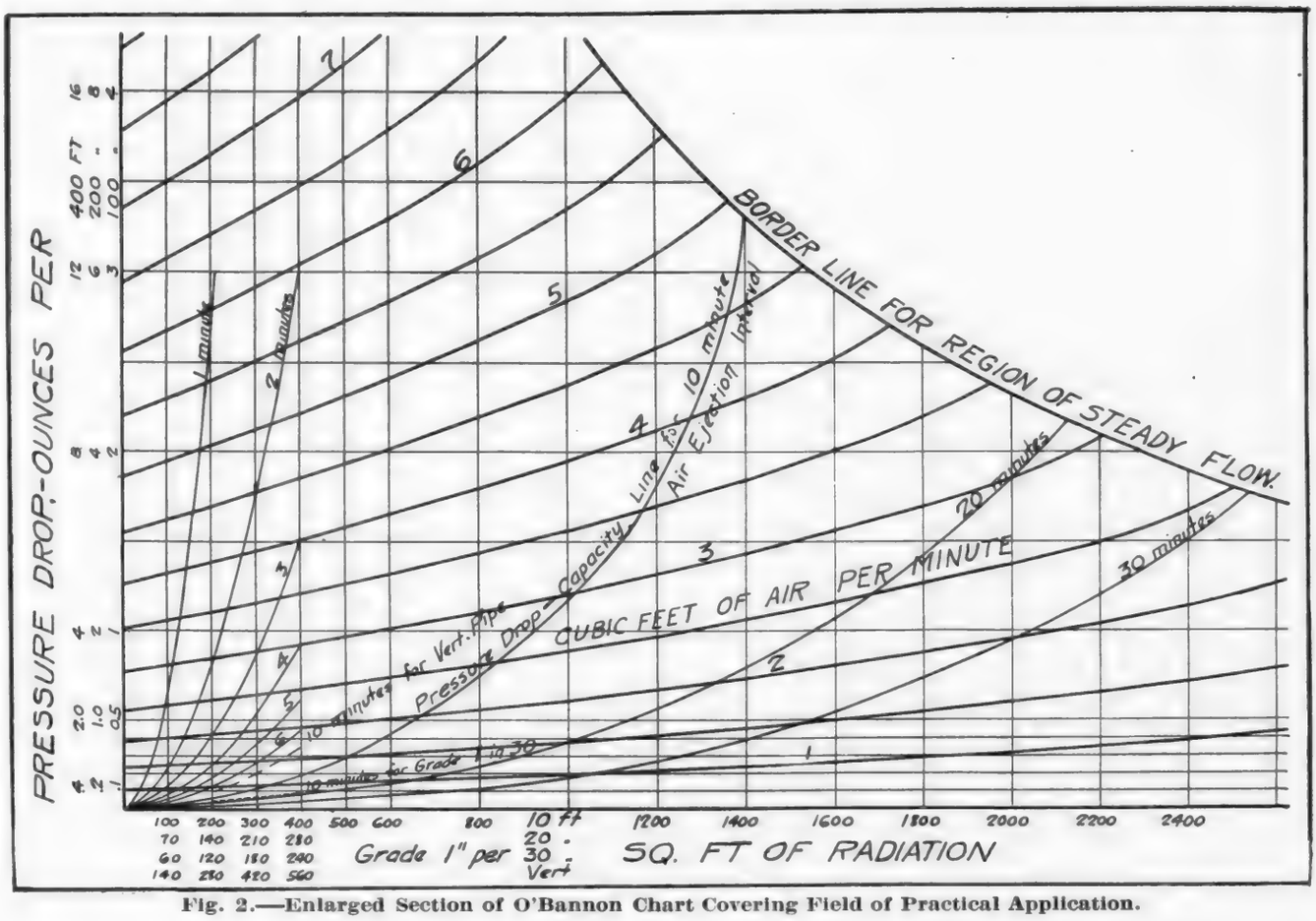


Fig. 2.—Enlarged Section of O'Bannon Chart Covering Field of Practical Application.

CONDITIONS AFFECTING SIZE OF RETURN LINE

Having prepared the chart, the conditions entering into the proportioning of the return line can be studied. Assume that we have a capacity load of 300 sq. ft. of radiation for a 1-in. dry-return line. Fig. 2 shows capacities of 280 sq. ft. for a grade of 1 in. in 20 ft., 300 sq. ft. for a grade of 1 in. in 10 ft., and 280 sq. ft. for a vertical pipe. Since, under each of these conditions, the same volume of water is passing through the pipe in a unit of time, and also the same volume of air, the rate of flow of both the water and air is affected by the change of grade, and therefore, the pressure drop or resistance to the air flow decreases in proportion to the increase in grade. The change in resistance however, is very, very slight and can be ignored, as the total resistance itself is a very small factor, being approximately 0.1 oz. per 100 ft. of pipe.

However, if the load on the line is increased to 400 sq. ft., it is discovered that the resistance has taken a jump to about 0.18 oz., an increase of 80% as compared to but 33.3% increase in capacity, and if the capacity be further increased to 600 sq. ft., the pressure drop jumps to 0.45 oz., an increase of 450% in resistance, as compared to 200% increase in capacity.

If a longer time allowance is given for the ejection of the air in the radiator, a 1 in. pipe, graded 1 in. in 10 ft., will carry 600 sq. ft. of radiation with a pressure drop of less than 0.1 oz. per 100 ft., for a 30-min. interval, and that 1000 sq. ft. of radiation can be carried with a pressure drop not to exceed 0.2 oz. If the opposite direction is taken and an attempt made to eject the air in 3 min., then it is found that for 300 sq. ft. of radiation, the pressure drop increases to 0.8 oz., and for 400 sq. ft., to 1.5 oz.

It is well to note that all of these points are far below the *border line for region of steady flow;*

that is, any of the capacities that have been considered can be safely carried in a 1 in. pipe without danger of a turbulent or noisy flow.

In the case of air flow, it is apparent that the only effect to be considered is that with the increase in capacity and resultant increase in resistance to air flow, a point is reached at which the resistance in the return line balances the steam pressure in the radiator, and further increase in capacity causes an increase in the time for air ejection.

The increase in resistance to air flow has no effect whatever upon the flow of condensation.

EFFECT OF LENGTH OF RETURN LINE

The length of the return line can have no effect upon the flow of condensation, owing to the impulse to flow being caused by the grade of the line, but it does cause an increase in resistance to the flow of air, in direct proportion to the increase in length, with the result that a longer interval of time is required to eject the air in the radiator. The principal advantage to be gained by making a return line ample in size is to reduce to a minimum the back pressure on the radiator, thus causing a free flow of steam to the most distant radiator, and provided the steam supply lines are properly balanced, bring about a uniform heating of all radiators.

It is important, in the study of this problem that one maintain the proper perspective in order not to go to extremes. It is the writer's own inclination to lay great stress on the grade of the pipe, while others go to the other extreme in laying too great stress on the pressure drop; whereas, an examination of the chart shows that the same capacity can be carried in the same size pipe on a line in which the grade varies from 1 in. in 30 ft. to a vertical, without seriously affecting the pressure drop, and likewise, owing to the very low pressure drop under usual conditions, if the size of the line is changed to allow for increased length, the line becomes unbalanced to a greater extent than if one uniform size for all reasonable lengths is maintained.

INFLUENCE OF VARIOUS FACTORS UPON THE CARRYING CAPACITIES OF PIPES

The important problem to be solved by the aid of these charts is to select the ideal carrying capacity for each size of pipe. At present, the incomplete condition of the experimental work prohibits our going beyond the one size given on this chart; nevertheless, it is possible to illustrate very thoroughly, the influence of the contributing factors upon the carrying capacity.

First: It must be borne in mind that any capacity rating given to a pipe is based on ideal conditions, and that sufficient leeway must be allowed for abnormal conditions, such as a cold radiator and a cold room, which would tend to increase the condensation rate above normal. It is important that the capacity be kept well below the line for unsteady flow.

Second: The pressure resistance to flow must be maintained low, to permit uniform circulation, to avoid increased boiler pressure and to permit rapid ejection of air from the radiator.

As an example, suppose standard practice for a vapor or atmospheric system of circulation is selected. Assume 400 sq. ft. capacity as the rating for a 1 in. dry-return line for this class of work. An analysis of the O'Bannon chart shows that if the air in the radiator is ejected in 30 min. the resistance is 0.05 oz. per 100 ft. of pipe, if it is ejected in 20 min. the resistance is 0.1 oz., and if ejected in 10 min. the resistance is 0.2 oz. If the line is 400 ft. long, the resistances become 0.2 oz., 0.4 oz., and 0.8 oz., respectively. If an attempt is made to balance the capacities for the 400 ft. line as compared to the 100 ft., then the capacity must be reduced to less than 200 sq. ft. on the 400-ft. line in order to maintain the same pressure drop as for the 400 sq. ft. on the 100-ft. line. The resistances given are for the capacity of 400 sq. ft. in the pipe graded 1 in. in 10 ft. If the grade is decreased to 1 in 20 or 1 in 30 then the resistance is increased, but the proportional increase is so slight that the increased resistance amounts to but 0.025 oz. for the decrease in grade from 1 in. in 10 ft. to 1 in. in 30 ft.

PRESSURE DROP IN MODULATION SYSTEMS

In reference to the pressure drop in modulation systems, one well known authority makes the following statement:

> "Pressure drop in the return main is variable,—greatest during initial heating and dependent on length of run and maximum velocity. In a well-proportioned system, the pressure drop should never exceed 0.05 lbs. per square inch differential between the farthest radiator trap and the vent, and during normal heating is so slight as to be almost negligible."

In this quotation, a basic fact is so well stated, that the writer proposes to make this the basis for establishing the capacity of the dry-return lines for this class of service. The 0.05 lbs. pressure drop quoted,—equivalent to 0.08 oz., is the maximum resistance that we have allowed for a line of 1 in. pipe, 400 ft. long, carrying 400 sq. ft. of radiation.

RECOMMENDATION FOR STANDARD PRACTICE IN MODULATION, VAPOR OR ATMOSPHERIC SYSTEMS

Therefore, it is the writer's proposal that it be established as standard practice for modulation, vapor or atmospheric systems using radiator traps:

namely, that a 1-in. pipe, graded not less than 1 in. in 30 ft., and not exceeding 400 ft. in length, including allowance for turns in direction, be rated to carry the condensation and air from 400 sq. ft. of radiation gross, and that 10 min. be the maximum time interval for ejection of air from the radiator, or time for the radiator to heat completely.

Having established this basic standard, all pipe sizes can be rated in ratio to the above.

If the conditions for a vacuum line are maintained as stated: that is, the rating based on 400 ft. in length, and the time interval for air ejection set at 10 min., then there is a pressure drop of 2oz. per 400 ft., on 600 sq. ft. capacity in the 1-in. pipe. The conditions under which a vacuum operates vary from those of a modulation system, in that as soon as the air is ejected from the radiator, then re-evaporation of the water of condensation forms a considerable volume of vapor, which must be taken into account. If the evaporation is based at 2½% and the volume of vapor at 40 cu. ft. per pound, the resultant volume of vapor per minute is equivalent to the volume of air to be ejected per minute.

On this basis the rating for a 1-in. vacuum line, not to exceed 400 ft. in length, graded not less than 1 in. in 30 ft., would be rated at 600 sq. ft. If the line is increased to 800 ft. in length the capacity must be decreased to 440 sq. ft. in order that the pressure drop not exceed 2 oz. maximum. In establishing this rating the maximum allowable pressure drop was arbitrarily set at 2 oz. and on comparison the rating was found to agree very closely with what may be called standard practice.

All the foregoing discussion has been based on the parallel flow of water and air. Counter flow was also covered by the O'Bannon experiments, but an extended discussion is unnecessary as within the area covered by practical return-line proportions, the relationship between capacity and pressure drop differs but slightly from that on parallel flow.

In concluding his paper, Mr. Frost suggested that all return-line tables be reduced to one capacity for each size of pipe, with a statement of the limiting conditions under which the rating was established.

Further progress in the study of "Correlation of Skin Temperatures and Physiological Reactions" were presented in a paper on the subject by W. J. McConnell, M.D., and C. P. Yagloglou, of the society's Research Laboratory. While the results of these studies are of more significance to medical men than to heating and ventilating engineers, the facts brought out were declared by Dean Anderson to be "of inestimable value to the world at large." He felt that the character of the work done by Dr. McConnell and his associates was such as to deserve special recognition by the society and at a later session a formal resolution of appreciation was adopted in which the names were specifically mentioned of Dr. McConnell, and Messrs. R. R. Sayers, O. P. Hood, O. W. Armspach, C. F. Houghten and C. P. Yagloglou.

A paper on "Selecting Wall Stacks Scientifically for Gravity Warm-Air Heating Systems," by Professor V. S. Day of the University of Illinois, was presented by Professor A. C. Willard, who gave some illustrations of the practical use of the data.

At this point the meeting was turned over to L. A. Harding, general chairman of the Committee on Code of Minimum Requirements for the Heating and Ventilation of Buildings. Mr. Harding stated that he felt the committee's work was now practically completed and that the code was almost in shape to be adopted by the society. The present revision, he said, was the second which has been

American Society of Heating and Ventilating Engineers in Session in Kansas City, June 10-12.

made by the committee which has devoted an endless number of meetings and conferences to consideration of the code. He called upon Dean Anderson to present Section 1 on "Definition of Terms," etc. Dean Anderson stated that while his section occupied the opening place, its consideration and final arrangement should await the completion of every other portion of the code.

Chairman A. C. Willard of the sub-committee on "Requirements for Heating Buildings," then presented the changes and revisions which had been made in Section 3. This is the section which, it is felt by the Heating and Piping Contractors' National Association, parallels the code published by that body.

Professor Willard stated that the two codes agree within four-tenths of 1%, as far as results are concerned, on two typical buildings which had been figured by both methods. Further discussion of this and other sections was deferred to the Thursday morning session.

Wednesday Morning Research Session, June 11

Wednesday morning was devoted to the society's Research Laboratory and to the numerous papers which had been submitted by the Research Laboratory staff. It was at the opening of this meeting that Chairman William H. Driscoll of the Committee on Research made his announcement regarding the new plan for the support of the Laboratory.

The five-year period, he said, is at an end, but in the meantime the Laboratory has become a part of the bone and sinew of the society. "We are not going to let the Laboratory die," declared Mr. Driscoll. "We have accomplished too much to quit at this particular stage."

Mr. Driscoll told of the enthusiastic response he had received to his letter to the membership which he sent out when he assumed the position of chairman and, meeting some of the points raised, he said it was not the function of the Laboratory to put the data it had obtained into shape for practical use by the membership. A committee, however, has been appointed for this purpose, under the chairmanship of Alfred Kellogg of Boston. After his committee makes a study of the array of literature which the Research Laboratory has turned out, numbering some 56 papers and reports of investigations, it is proposed to have the various chapters work on certain portions of the data and whip them into shape for practical use.

"We must have an income," declared Mr. Driscoll, "so that we can follow a stated program." To that end he stated that an increase of $10.00 in each member's dues would be proposed in the form of an amendment to the by-laws, with the specific understanding that all of this increase would be deposited in the research fund. The plan for securing the additional necessary funds to meet the Laboratory's $30,000 budget will be secured by raising the rates for space in the society's *Guide*.

In addition, it is proposed to establish supporting or sustaining memberships. Finally the idea of conducting commercial tests at the Laboratory is under consideration and in this connection he referred to the recent meeting of 23 boiler manufacturers and their representatives at the Research Laboratory in Pittsburgh, under the chairmanship of Vice-President S. E. Dibble where the project was discussed of testing all makes of cast-iron boilers with a view of arriving at some common basis for rating boilers. Mr. Driscoll characterized this as one of the most important movements which had been made in the industry and he looked to see far-reaching results come from it.

At the conclusion of Mr. Driscoll's remarks, the meeting was turned over to Dean Anderson. The first Research Laboratory paper to be presented was on "Effective Temperature Applied to Industrial Ventilation Problem," by C. P. Yagloglou and W. E. Miller. "Practical Applications of the Heat Flow Meter" by P. Nichols, which was next presented, proved a timely supplement to his former paper on this remarkable instrument.

Dean Anderson presented in abstract the papers on "A Simple Method of Using the Katathermometer to Show the Effect of Air Motion on Human Beings," by Margaret Ingels; "Some Additional Information Concerning Air Leakage Around Window Openings," by C. C. Schrader; "The Heat Given Up by the Human Body and Its Effect on Heating and Ventilation Problems," by C. P. Yagloglou, and, a paper on "The Flow of Steam and Condensation as Affected by High Pressures, Horizontal Offsets and Valves," by Louis Ebin and R. L. Lincoln.

Dean Anderson then launched into one of his characteristic addresses on the work and place of the Research Laboratory. He spoke of the 56 papers submitted by the laboratory on matters directly connected with heating and ventilation, and declared them a notable contribution to Science. Research work, he declared, is a field in which we have to be courageous and dip into realms where the way out is very often not charted at all. Frequently we come against a fence and have to turn back.

Dean Anderson urged a broader outlook on the part of all. "We must be in sympathy with the work of every man," he declared. "No man accomplishes anything who complains of everything. Every man can contribute his part. Some of the achievements now being made at the Laboratory may only have their application fifty years from now. Have faith in the men who organized this laboratory."

The work of Pasteur was cited by Dean Anderson as typical of the accomplishments which come through patient research. We know now that repeated injection of increasingly strong amounts of hydrophobia serum make us immune to that terrible affliction but it took Pasteur a long time to find

out that hydrophobia serum becomes inert in 21 days.

Another instance cited by Dean Anderson was the development of the Crookes vacuum tube, now so widely used in connection with radio. To show how long scientific discoveries often take in becoming of practical use, he stated that years ago he participated in some of the first experiments in the use of the Crookes tube and at that time, of course, its possibilities for radio work, were not dreamed of.

Air Leakage Around Window Openings

Mr. Schrader's paper contained test data which supplemented the data presented in his previous paper (see THE HEATING AND VENTILATING MAGAZINE for February, 1924). In that paper the tests were all made on the air leakage through the window crack. The present report deals with the effect of

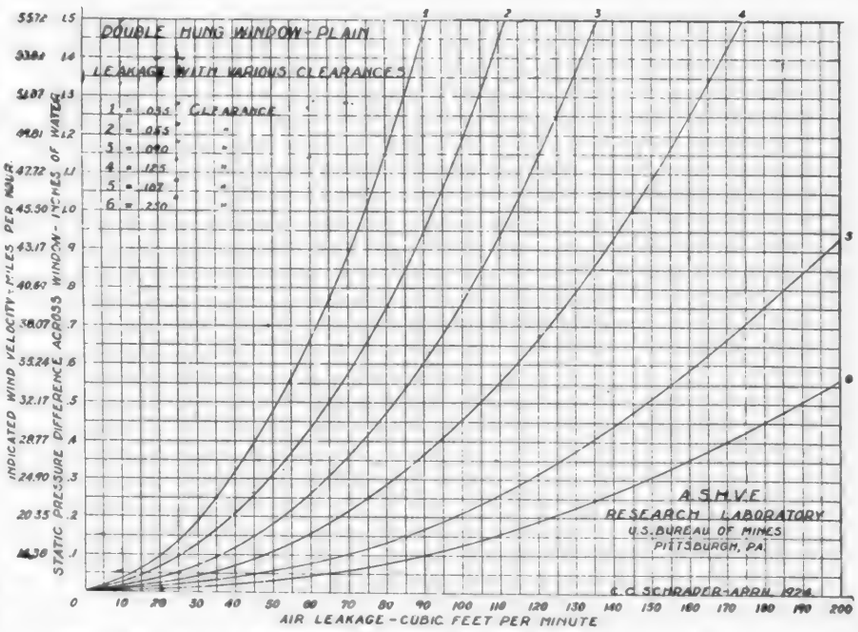

DOUBLE HUNG WINDOW - PLAIN
LEAKAGE WITH VARIOUS CLEARANCES
1 = .035" CLEARANCE
2 = .055 "
3 = .090 "
4 = .125 "
5 = .187 "
6 = .250 "
INDICATED WIND VELOCITY - MILES PER HOUR
STATIC PRESSURE DIFFERENCE ACROSS WINDOW - INCHES OF WATER
AIR LEAKAGE - CUBIC FEET PER MINUTE
A.S.H.V.E.
RESEARCH LABORATORY
U.S. BUREAU OF MINES
PITTSBURGH, PA.
C.C. SCHRADER - APRIL 1924

Fig. 2—Leakage Through Plain Window with Various Clearances.

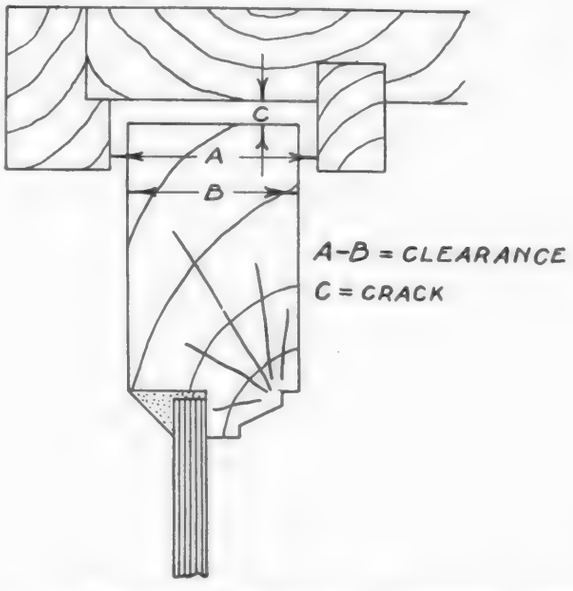


Fig. 1—Diagram Illustrating Distinction Between Crack and Clearance.

increasing the width of the stile, that is, increasing the clearance. There is an important difference here, as is shown by the accompanying illustration and many feel that the vital factor in window leakage is the clearance, rather than the crack.

Taking, for instance, a plain window, the new tests proved that the crack around the perimeter of the sash has no appreciable effect on the leakage, but the leakage increases rapidly with the increase in clearance.

In the first report it was shown that the leakage through a weatherstripped window increased as the crack was made larger. Fig. 4 shows what happens when the crack is kept constant and the clearance increased in a window with an interlocking strip applied. The increase in leakage with increase in clearance, states Mr. Schrader, is probably due to greater leakage through the pulley holes which is caused by decreased resistance in the path of the air to the pulley holes. The increase in leakage is quite pronounced until the clearance becomes equal to the crack, after which the increase is not so rapid.

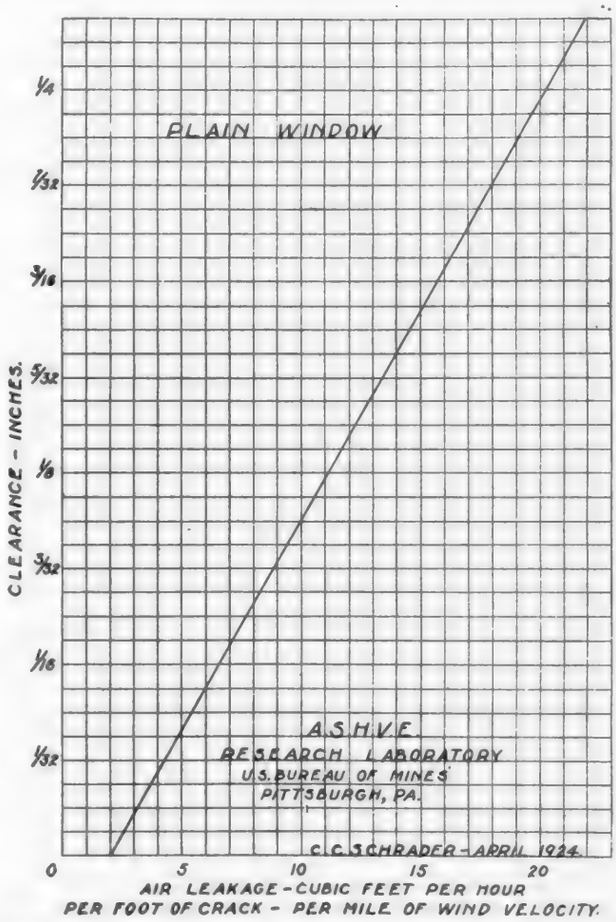


Fig. 3—Relation of Leakage Per Foot to Clearance, Plain Window.

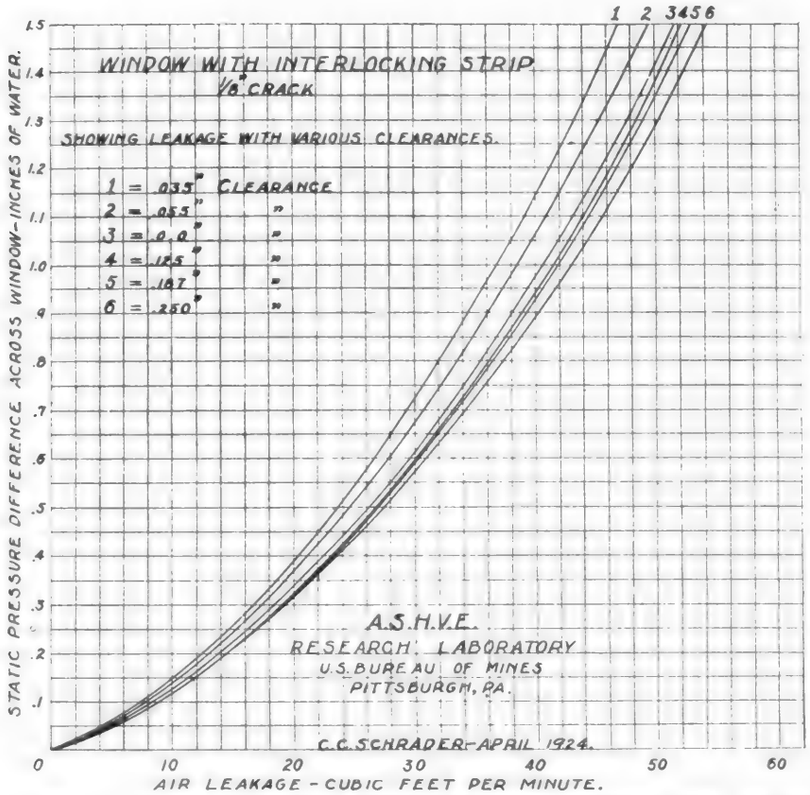


Fig. 4—Leakage Through Weather-Stripped Window with Various Clearances.

No tables of leakage were included in the report because any values desired can easily be found from the curves. Another reason is that the most important factor in the problem of infiltration is not yet definitely determined. This factor is the clearance of the average window after it has been in service long enough to reach its final condition in regard to shrinkage.

At the conclusion of this session it was announced that, in addition to the scheduled entertainment program, inspection trips had been arranged to the new Westport Junior High School, the N. E. Power Station and to the Kansas City stockyard district.

Thursday Morning Code Session

All of the morning session on Thursday and a good part of the closing session on the same day was devoted to the proposed Code of Minimum Requirements for the Heating and Ventilation of Buildings.

Continuing the discussion of Section 3, on "Requirements for Heating Buildings," C. F. Eveleth urged that efforts be made to harmonize the proposed standards of the heating engineers and of the heating contractors. Mr. Hart pointed out that the society's proposed code had never been distributed to the members. Professor Willard said the only essential difference between the two codes was in the matter of the base temperatures used. Mr. Hallett rather favored the plan of accepting the section as presented and providing for a conference with the heating contractors to prepare subsequent revisions. Many felt this course would make subsequent changes difficult. It was finally voted to "receive" the report.

A point was brought up by Alfred M. Lane urging the substitution of the "air infiltration" basis for the "air change" basis. Mr. Harding felt that we need more data on wall infiltration before abandoning the "air change" basis. At the same time, he expressed his agreement with Mr. Lane as to the correctness of his suggestion.

Section 2, covering "Ventilating Requirements for Public Buildings" was presented by Dr. E. V. Hill. Dr. Hill made a spirited defense of the Synthetic Air Chart method of determining the efficiency of ventilating methods and declared he could see no more difficulty in getting accustomed to this method than is experienced with the present methods. He called attention to the addition of "Specific Requirements Based on the Synthetic Air Chart," in which the percentages for various interiors were listed; also to the addition of "Suggested Types of Equipment for Different Synthetic Air Chart Percentages." These two additions, he said, met the criticisms of those who felt that the method was not sufficiently practical. He said the method as outlined seemed to him to be a simple and practical arrangement and he could not see how it was possible to meet the requirements of a testing code in any other way.

Section 4 on "Direct Steam or Hot-Water Radiation" aroused some lively comments. Dr. Hill felt that the whole section should be eliminated from the code or at least placed in an appendix. Sections like this, he declared, would limit the development of new ideas in the art. He thought the strictly legal matter should form the substance of the code and the extra-legal matter should be separated from it.

The presence in the hall of John Harrington, a former president of the American Society of Mechanical Engineers, led to an invitation for him to address the meeting. Mr. Harrington expressed his pleasure in being present during the discussions on the code, as well as during the research session. He complimented the society on the extent of its research work, declaring that it was out of all proportion to that conducted by other national engineering societies in proportion to its size.

Final Session, Thursday Afternoon, June 12.

Before proceeding with the code discussion, the regular program was resumed with the presentation of a paper by Frank E. Hartman on "Ozone and Its Use in Ventilation." Mr. Hartman broke away

from his text at frequent intervals giving the members some interesting sidelights on his experiences with ozone which proved highly entertaining and instructive.

Ozone and Its Use in Ventilation

By Frank E. Hartman

One of the important points made by Mr. Hartman in this paper was that clean and reasonably dry air is essential to the best efficiency, constancy of output and continuous operation of an ozonizer. For this reason he advocated the practice of producing ozone in totally-enclosed generators that utilize only a very small quantity of air for producing relatively high concentration of ozone, and subsequently introducing this ozonized air into the fan inlet in the proper quantities to produce the desired concentration in the circulated air.

Mr. Hartman made the argument that the brush discharge is very energetic in the precipitation of vapors and solid particles suspended in a gas. Also, that if the air contains dust or water vapors, a large portion of each will be precipitated by the discharge and lodged either on the electrode or diaelectric, while such an escape precipitation will carry off electric charges, thus decreasing the ozone output of the generator. In addition, the presence of dust on an electrode or diaelectric he stated, appreciably changes the character of the discharge and seriously interferes with the ozone production.

Mr. Hartman presented charts to show the necessity of properly-conditioned air. No ill effects, he said, are noted with air having a relative humidity of 10% to 15% at a dry-bub temperature of 70° F.

WHAT IS AN ODOR?

Another interesting matter taken up by Mr. Hartman was the question of odors. The writer, he said, has frequently been asked, "What is an odor?" and adds:

"Primarily, the differences and confusions of opinions held concerning the nature of an odor apparently arise from a misunderstanding of the popular statement that it is yet undecided whether the sense of smell depends upon a chemical or a physical process. It appears that some people misinterpret this reference to a physical process, and they are led to believe that the sense of smell is stimulated by energy emanations analogous to the radio active, or generally electrical in character. Those holding such views attempt to defend them by stating that a substance may give rise to prodigious quantities of odors without itself losing weight, and, therefore, odor must arise from an emanation rather than a volatilization of the substance.

"Now it is well known among scientists that electrical and thermal stimuli do not give rise to olfactory sensations. When the teeth have metallic fillings, and the body is charged with electricity, electrolysis frequently occurs in the mouth and stimulates the taste bulbs. Taste is frequently associated with smell *(i. e.)* giving rise to a sensation of flavor and one sensation is commonly confused with the other. For instance, chloroform excites taste alone, but is frequently spoken of as the odor of chloroform, while garlic, asafoetida, and vanilla excite only smell, though it is customary to ascribe a distinct taste to these substances.

"It is generally conceded by physiologists that substance must be brought into direct contact with the rod cells of the olfactory membrane, in order that it may excite odor. As the free olfactory surface is always covered with a fluid secretion it is essential that the odoriferous substance be soluble in this fluid in order that it may reach the rod cells.

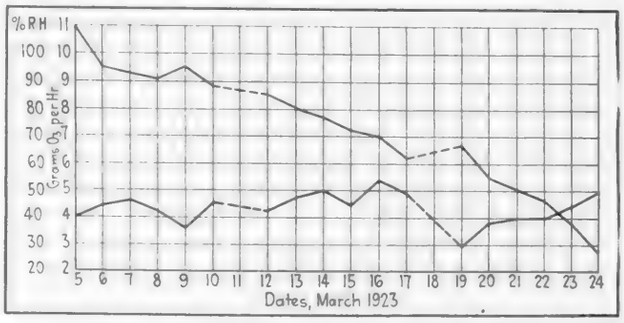


Fig. 1—Production of Ozone from Unconditioned Air.

Such a consideration at once points to a chemical process. However, Venturi, Prevost and Liegeois have studied the well known movement of odoriferous particles such as camphor, succinic acid, etc., when placed on the surface of water, and they suggest that a similar movement of such particles on the fluid of the olfactory membrane may cause an irritation that excited smell, and thus the stimulation would be mechanical or physical in character. This is the basis of the physical theory, and a very inadequate basis too, since with such an hypothesis it is indeed hard to account for the ability of the senses to differentiate between odors.

"It has been pointed out that in order to stimulate the olfactory center, it is essential that the substance comes into contact with the rod cells, also that these rod cells are protected by a fluid secretion. It is thought by some authorities that the odoriferous substance dissolves in the fluid and may exert a chemical effect that stimulates the sense of smell. This is the basis of the chemical theory, and since the sense of taste is considered to be stimulated through the solution of the sapid substances in the saliva, which in turn set up chemical action in the taste bulbs, it is reasonable to believe that the mechanism of smell is not very different, since the two senses are so closely allied.

"We are now concerned with the nature of odoriferous particles, and how they reach the olfactory membrane. These particles are usually gaseous, or in a condition of vapor, and diffuse through the air, according to the well known laws of gaseous diffusion. Non-volatile substances, or those having

a very low vapor tension rarely excite smell, while the readily volatile substances such as iodine, bromine, etc., always excite smell."

THE OXIDIZING EFFECTS OF OZONE

Mr. Hartman came out very emphatically in favor of the oxidizing effect, rather than the masking effect, of ozone and cited particularly the work of numerous investigators in the purification of water with ozone. He emphasized his belief, however, that ozone by itself is not stimulating, but is rather remedial. "I believe," he said, "that the function of ozone is that of a scavenger, it keeps the air so pure that we will involuntarily breathe properly. Of all the automatic mechanism that modern genius and experiment have devised, there is nothing mechanical that any way near approaches

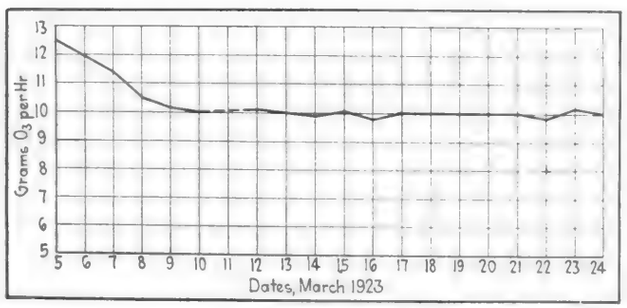


Fig. 2—Production of Ozone from Conditioned Air.

the delicacy of the automatic control of the human body. The rapidity with which the pores of the skin respond to even minute changes in temperature has never been rivaled by the thermocouples or expanding gases or liquids.

"As we pass from a warmer to a cooler atmosphere our skin automatically contracts so as to afford its maximum protection. A study of gland secretions is very illuminative of the extent of the automatic function of the body. This automatic control extends to our respirations. When the air contains even minute and practically imperceptible quantities of disagreeable odors, we involuntarily shorten our breathing, and though rate of respiration may increase under such conditions, the total volume of oxygen taken into our lungs is appreciably diminished. Our respiratory system has a definite, and important work to perform.

"The amount of oxygen that can be conveyed throughout our body is contingent upon the amount of aeration that our blood received. If foul air causes us to decrease the amount of air taken into our lungs it naturally follows that our blood will receive insufficient aeration, and, in consequence, impurities will remain in our system to cause autointoxication. Intoxication of this character is conducive to anemia, as the amount of haemoglobin will ultimately be decreased. Its immediate effects are headaches, and general lassitude that inhibits a free exercise of the mental faculties, and is further productive of physical fatigue.

"To those unfamiliar with problems involving great effects from a very small amount of substance, it may seem astounding to say that a quantity of flucrescein, of the volume of 1 cu. in. is sufficient to color, to a distinct green, a body of water as large as our combined great lakes. This is true, however, and a consideration of it will assist in visualizing what is to follow.

"When odors are perceptible the substance is present in the air either as a gas, a vapor, or in a state of exceedingly fine division. An idea of the fineness of odoriferous particles may be gained by conveying air containing an odor to the nostrils through a tube packed with cotton wool. It will be found that the odor is still discernible, and such a tube is capable of filtering from the air microorganisms of less than 1/100,000 of an inch in diameter.

"A grain of musk will scent up an apartment for years without appreciable loss of weight. In fact, musk to an amount of two millionth of a milligram (1 milligram 0.0154 grains), or one part of hydrogen sulphide in 1,000,000 parts of air, may be perceived by the sense of smell. The smell of mercaptan has been detected when the dilution was 1:50,000,000,000, and it was calculated that the weight of mercaptan so detected was $_1/_{400\,000\,000}$ of a milligram in 50 cc. of air (E. Fischer & Penzolalt).

"From this it is seen that the sense of smell is

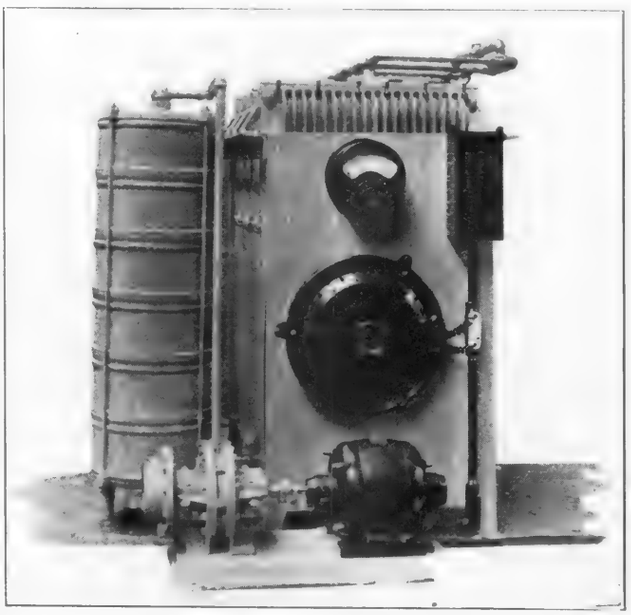


Fig. 6—Motored Blower Which Supplies Air to Two Dehydrators and Cotton Filters, Thence to the Ozone Generators.

exceedingly delicate, and with odors we are dealing with almost infinitely small quantities, therefore, the fact that a loss of weight is not detected can be ascribed only to our present crude methods of weighing. The foregoing considerations throw considerable light on odors in general, and indicate the necessity of specific measures for their elimination in a ventilating system, since so small an amount of substance can cause so much odor."

Mr. Hartman quoted from experiments to show that the recirculation of at least 75% of the air used in ventilating a building can be accomplished without fear of increasing the CO_2 content to anything like a dangerous quantity. The only difficulty, he said, experienced in recirculation arises from the presence of odors in the recirculated air. When provisions are made for removing the odors, up to 75% of the air can be recirculated without impairing its quality, as tested by the Synthetic Air Chart.

Mr. Hartman concluded his paper with a description of an ozone generator designed to produce ozone in a separate chamber. To give some idea of the small quantity of air required by the generators, Mr. Hartman stated that it was necessary to supply only 4 cu. ft. of air per minute in order to produce an ozone concentration of 0.1 parts of ozone per million parts of air in 100,000 cu. ft. per minute of the circulated air. An illustration was included of such a machine with this capacity. A motored blower is used, which supplies the air to two dehydrators and cotton filters, and thence to the ozone generators. By thus conditioning the air to be ozonized, use is made of a watt meter calibrated in the terms of ozone for indicating the concentration produced at any given energy input. The energy input is controlled by a rheostat.

Where the fans are operated at variable speeds red marks on the scale of the ozone meter show the quantity of ozone to use with each of the fan speeds, and the operator may turn the rheostat until the meter indicates the proper quantity of ozone. When push buttons are used for definite fan speeds, the rheostat may be phased with the fan motor so that it is only necessary to press the push button to operate both the fan and the ozonizer. The ozonizer will thus automatically cut on the proper quantity of ozone.

One of the most important ventilation papers of the meeting was then presented. It was entitled "Modern Trend in the Science of Ventilation," by Perry West. In the absence of the author, the paper was presented in abstract by Dr. Hill, who expressed his general agreement with the suggestions of Mr. West, especially with regard to modifications of the Synthetic Air Chart which was originated by Dr. Hill.

Modern Trend in the Science of Ventilation

By Perry West

Mr. West's paper was a frank discussion of the changed views now held regarding the requirements to be met in heating and ventilating buildings. He reviewed at length the original "quantity" basis of ventilation, designed to counterbalance the supposed ill effects of CO_2. He gave credit to W. A. Evans, of Chicago, and Dr. Luther Gulick, of New York, as the men who started the modern trend of ventilation in this country in 1911, which led to the present ventilation standards, based upon quality, rather than on quantity of the air supply. He also mentioned the contributions of Dr. E. V. Hill and many others to the present state of the art.

Mr. West then considered the Synthetic Air Chart as devised by Dr. Hill and brought up a number of points which, he felt, would improve the chart. The gist of his suggestions were incorporated in a "modified" Synthetic Air Chart. Among the more notable changes suggested are the substitution of "effective temperature" for "wet-bulb temperature" and the readings of all the plus percentage columns up from a zero or minimum base line towards the top of the chart, while the deduction columns all read downward.

Mr. West brought up the point that one of the reasons why the Synthetic Air Chart has not been more widely used is that there has been no key to define what percentages of ventilation, as shown by this chart, would be considered good practice for a given building, but he said this need had now been met in a table compiled by Dr. Hill, giving recommended percentages of perfect ventilation for different classes of buildings when tested according to the Synthetic Air Chart. This has been further supplemented, during the past year, by Dr. Hill's list of suggested types of equipment for securing different Synthetic Air Chart percentages, thus enabling the engineer to select the type of equipment necessary to comply with any given percentage.

The following directions are given by Mr. West for using his modified Synthetic Air Chart, taking, as an example, the following test data:

Dry bulb temperature...	72°.
Wet bulb temperature...	58°.
Air motion.....	20 ft. per min.
Physical state.....	Light work.
Dust.....	10,000 particles per cu. ft.
Bacteria.....	10 colonies on a 2 min. plate.
Odors.....	90% free from
CO_2.....	7 parts per 10,000.
Other injurious substances.....	None.
Distribution.....	81.4.

The values are plotted on the modified chart as follows:

Referring to the Comfort Chart (Pp. 134-135 A. S. H. & V. E. Guide)*, it will be seen that a dry-bulb temperature of 72°, with a wet-bulb temperature of 58° shows an effective temperature of 65.25°. It will be seen (P. 180, Journal of A. S. H. & V. E. for February, 1924, Fig. 10) that the air motion of 20 ft. per minute would reduce this effective temperature about 0.75°. Assuming from previous data that the state of light work would reduce the comfort line 1½°, it would bring this to 62½°, instead of 64°. This will leave the effective temperature difference of 2°.

This corresponds to a deduction of 5% for this particular column leaving a plus percentage of 95%. This 5% deduction in the effective temperature column corresponds to a deduction of 4.5% in the final percentage of perfection column.

* See Heating and Ventilating Magazine for March, 1924.

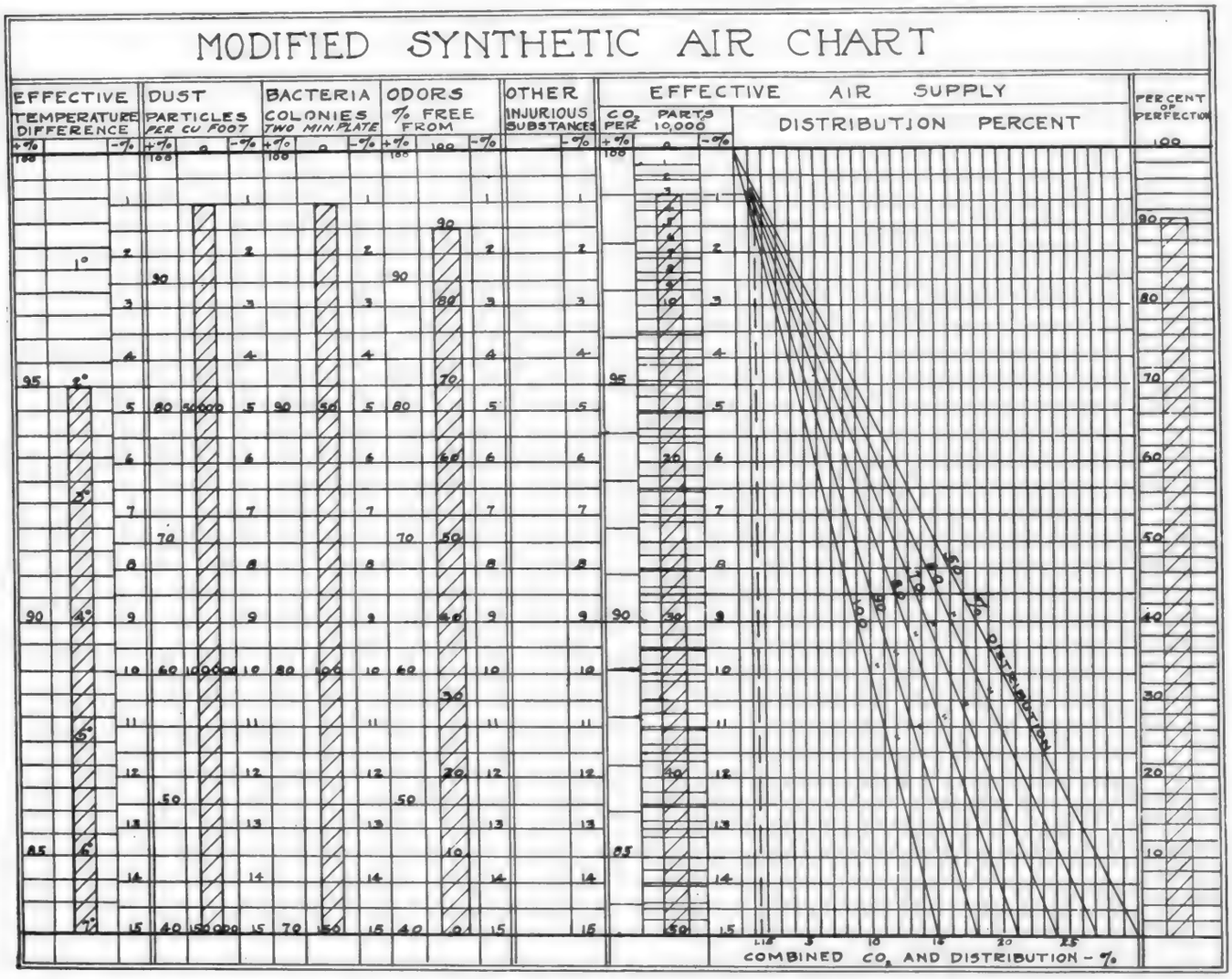
The 10,000 particles of dust correspond to 96 % in the plus column for this particular department and a minus 1% to be deducted in the final percentage of perfection column.

The 10 colonies of bacteria correspond to 98% in the plus column for this department and a minus 1% to be deducted in the final percentage of perfection column.

The 90% freedom from odors correspond to 94% in this particular column and a deduction of 1.5% for the final percentage of perfection column.

For effective temperature difference	minus 4.5%
For dust,	minus 1%
For bacteria,	minus 1%
For odors,	minus 1.5%
For effective air supply,	minus 1.15%
Total	9.15%

This deducted from 100% leaves 90.85% which is plotted in the final percentage of perfection column.



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Modified Form of Synthetic Air Chart Suggested by Perry West.

The seven parts of CO_2 (3 parts above the normal CO_2 contents of the outside air) correspond to a plus percentage of 99% for this particular department and a deduction of 0.9% in the minus column.

This 0.9% is extended over to the diagonal line corresponding to 80% distribution and from the intersection of these two lines a perpendicular is dropped to the line showing the combined minus per cent for CO_2 and distribution, which is found to be 1.15.

Adding these several deductions we have the following:

Most of the balance of this session was devoted to the discussion of additional sections of the proposed heating and ventilation code. Section 5 on "Indirect Steam and Hot-Water Radiation" was presented by L. C. Soule. Section 6 on "Heating Boiler Capacity" was presented by J. F. McIntire.

Under this heating boiler section the matter of cast-iron boiler ratings had an airing. Reference was made to the start which had been brought about through the gathering of cast-iron boiler manufacturers at the Research Laboratory the month before, the statement being made that this

E. Vernon Hill's Table of Recommended Percentages of Ventilation Perfection for Different Classes of Buildings when Tested According to the Synthetic Air Chart

Schools	New Buildings %	Existing Buildings %
Class Rooms	95	90
Manual Training Rooms	90	85
Domestic Science Rooms	90	85
Assembly Rooms	90	85
Toilet Rooms	85	80
Corridors	85	80
Churches	85	80
Hospitals		
Wards	95	90
Operating Rooms	98	93
Other Rooms	90	85
Theatres		
Seating Sections	90	85
Dressing Rooms, etc.	85	80
Dance, Lodge and Assembly Halls	88	83
Office Buildings		
Offices in office buildings or other buildings where persons are continuously employed	90	85

Factory Buildings

The percentage desirable for factory buildings will vary over a considerable range, depending upon the character of the work and of the process employed, modified to a considerable degree by the dust content of the air and the possibility of maintaining it free from objectionable dust and fumes. This will require a careful classification and considerable study.

E. Vernon Hill's Suggested Types of Equipment for Different Air Chart Percentages

The following classification is given to assist the engineer in selecting the type of equipment necessary to comply with certain percentages on the Synthetic Air Chart. It will be understood that considerable variation will be found in a certain class of equipment due to individual ideas on the part of the designer, the character of the installation work, the location of the building in which the equipment is installed, etc., nevertheless, it can be stated that if the equipment is properly designed, installed and operated it will give at least the percentage under the classification. The classification, moreover, is not arbitrary, but based on sound logic, amply sustained by experience.

Class A — 100% Equipment. A mechanical supply and exhaust system consisting of the following:

1. Positive air supply having a maximum capacity of 30 c.f.m. per occupant.
2. Mechanical exhaust equipment with exhaust registers effectively located.
3. Perfect air distribution.
4. Accurate automatic temperature control.
5. Efficient humidifying devices.
6. Accurate automatic humidity controlling apparatus.
7. Efficient air washers filters or other air cleaning devices, having an efficient not less than 99%.

It is understood that a 100% efficient equipment is a physical impossibility owing to the fact that to secure a 100% result would necessarily mean that air cleaning devices be 100% efficient; that temperature and humidity control maintain temperature and humidity conditions absolutely on the comfort curve; that air distribution be perfect, etc. All these results cannot be obtained although a 99% apparatus and an approximately 99% test by the Synthetic Air Chart is possible.

Class B—95% Equipment. Mechanical supply system consisting of the following:

1. A positive air supply with a maximum capacity of 30 c.f.m. per occupant.
2. A well designed gravity exhaust system.
3. Efficient air distribution.
4. Accurate temperature control.
5. Adequate humidifying apparatus.
6. Adequate humidity control.

Air cleaning devices have been omitted in the 95% equipment as this percentage can be obtained under ordinary conditions without air washers or filters. In an exceptionally clean locality, much high percentages can be obtained.

Class C—90% Equipment. A mechanical supply system consisting of the following:

1. An adequate air supply with 30 c.f.m. per occupant.
2. Gravity exhaust.
3. Efficient air distribution.
4. Automatic temperature control.
5. Adequate humidifying apparatus.
6. Humidity control in the main duct only or from a typical room.

Class D—85% Equipment. A mechanical system consisting of the following:

1. An accurate air supply with a maximum capacity of 30 c.f.m. per occupant.
2. Gravity exhaust or exhaust openings.
3. Good air distribution.
4. Automatic temperature control.

Class E—80% Equipment.

1. A positive air supply with gravity exhaust, but without air cleaning devices, humidifying apparatus, temperature and humidity control.
2. Direct-indirect systems with either mechanical or gravity exhaust.
3. Open window or other so-called natural systems of ventilation.

was the first time the boiler men had come together with the definite idea of considering a uniform basis of boiler ratings. It was voted to appoint a conference committee to act with the boiler manufacturers, those named to act for the society being S. E. Dibble, John Blizard and L. A. Harding.

Before the meeting adjourned, it was announced that Seattle had sent in a petition for a local chapter, to be known as the Pacific Northwest Chapter and to embrace the territory covered by Washington, Oregon, Idaho, western Montana, western Canada and Alaska.

In a report from a committee appointed to investigate the matter of raising an endowment fund for the Research Laboratory, it was stated that this plan was not considered practicable by the committee. It was urged however, that the committee be empowered to go to the proper government officials with a view of trying to have the government establish a Research Laboratory in heating and ventilation. In that case the society could afford to subsidize such a laboratory to the extent of, say, $20,000.

A formal resolution of thanks to the Kansas City Chapter, for its hospitality, proposed by C. F. Eveleth, was enthusiastically carried by a standing vote.

President W. T. Jones of the Massachusetts Chapter extended a warm invitation to the Kansas City members and others present to attend the next annual meeting of the society which, he said, will be held in Boston in January.

The meeting then adjourned.

Kansas City Shows Spirit of Western Hospitality

The impressive thing about the welcome and hospitality extended by the Kansas City members to their guests at the summer meeting of the American Society of Heating and Ventilating Engineers, was the manifest sincerity of the greeting. It was very evident that Kansas City was pleased to have the members meet there and was eager to show the eastern delegates the city's progress and accomplishments.

On the opening day of the meeting, the convention party was invited to take luncheon on the roof of the Kansas City Athletic Club. This is a 15-story building in the heart of the city and the views from its four sides gave a clear idea of the city's general layout. From one side, for instance, could be seen the site of Westport Landing where the "covered wagon" trains started on their long trail westward. Another view showed the flats and the Missouri and Kaw Rivers, with the extensive stock yards and railroad facilities.

In the opposite direction the guests were shown the residential district of Kansas City stretching away to the horizon across a sweep of rolling country which proved fully as attractive on closer inspection, the next day, as it did from this viewpoint.

Immediately after the afternoon session on the opening day (Tuesday) automobiles took the entire convention party on a tour of the city, passing first around the bluffs in the downtown district and then winding out through the new "country club" district. The weather was ideal for the trip and the presence of a number of motorcycle policemen who accompanied the party made the trip literally an uninterrupted delight. Few were prepared for the scenes which greeted them as they came upon vista after vista of extensive private estates whose architectural schemes made of the whole section one vast park, notable as much for its taste and restraint as for its intrinsic beauty.

The drive wound up at the Mission Hills Golf Club. Here dinner was served amid delightful surroundings. While the rooms were being cleared the party adjourned to the piazzas and witnessed a lawn dance given by a youthful nymph under the beams of a golden spotlight. A trio of negro singers then appeared and sang delightfully. In the meantime dancing commenced within the clubhouse and continued until a late hour.

The following day (Wednesday) the session closed early to enable those in the golf tournament to get out on the links, as well as to provide for the inspection trips to the Westport Junior High School, the N. E. Power Station and the Kansas City Stock Yards.

In the evening the entertainment reached its climax with the informal banquet and entertainment in the ballroom of the Hotel Muehlebach. The speakers' table was banked with flowers, the effect being heightened by miniature water fountains at each end of the table.

No sooner had the guests been seated than the lights were turned low and a procession of waiters appeared bearing aloft letters in solid ice of "A. S. H. & V. E.," preceded by an electrically-lighted Statue of Liberty.

In this, as in many of the other details of the entertainment, the hand of General Chairman John H. Kitchen was detected, and the diners expressed their enthusiasm by rounds of applause.

When the speechmaking began, Walter E. Gillham expressed the pleasure felt by the Kansas City Chapter in being able to welcome the society to the "Heart of America." He then introduced President Homer Addams who delighted his hearers with a novel account of the rise of the engineering art in Kansas City. The story had to do with an Indian aborigine and from the shaking of heads which

Dinner of the American Society of Heating and Ventilating Engineers at the Hotel Muehlebach, Kansas City, June 11, 1924

which greeted its recital, the writer hardly feels justified in passing it down to posterity as authentic in every detail. Suffice it to say that Mr. Addams's other story of the young Missouri soldier who asked for one look at the Liberty Bell before sailing overseas met a responsive chord and well illustrated the sentiment he expressed that the East and West are one.

With these preliminaries, the main speaker of the evening was introduced, being the Reverend Dr. Charles F. Aked, pastor of the First Methodist Church of Kansas City, formerly of New York, who delivered a prepared address on "Lloyd George." Dr. Aked gave some interesting reminiscenses of his acquaintance with Lloyd George with whom he participated in many of the political movements in England nearly a generation ago.

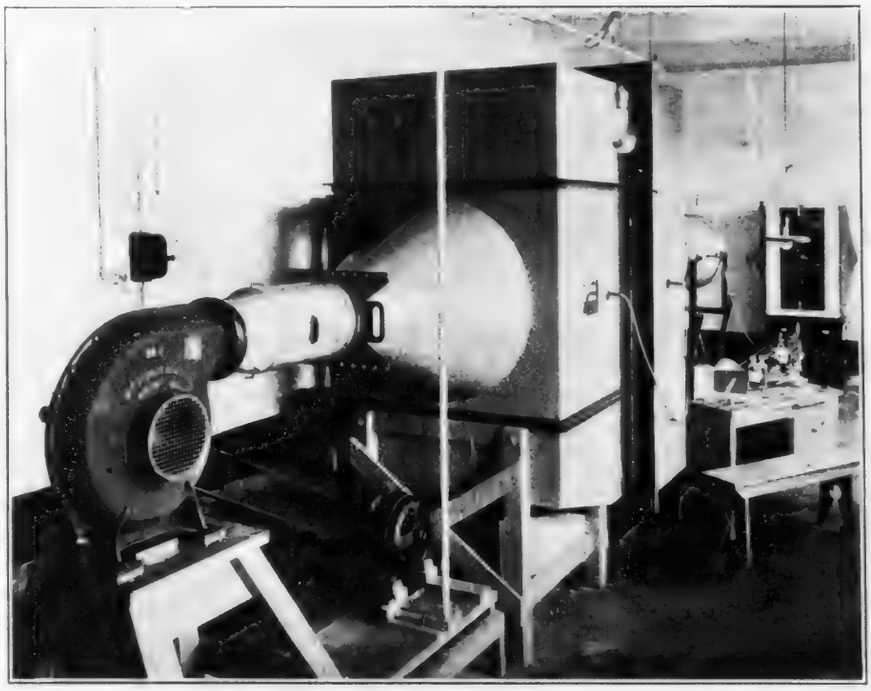
Special entertainment features for the ladies during the meeting included an automobile trip with luncheon at the Hillcrest Country Club, on Wednesday, and a luncheon and musicale on the Roof Garden of the Kansas City Club, on Thursday.

One of the events not scheduled was a delightful luncheon party given by a few of the Kansas City members at the Kansas City Club Thursday noon. This luncheon was attended by President Homer Addams, William N. McIntyre, president-elect of the Kansas City Chapter; Walter E. Gillham, president of the Kansas City Chapter; H. M. Hart, of Chicago; R. C. Stackhouse, Kansas City; L. A. Harding, Buffalo; A. S. Armagnac, New York; E. K. Campbell, Kansas City; J. H. Kitchen, Kansas City; Benj. Natkin, Kansas City; William T. Jones, president of the Massachusetts Chapter, Boston; C. F. Eveleth, Camden, N. J.; Charles W. Miller, president of the Wisconsin Chapter; J. H. Cutler, Chicago; William H. Driscoll, New York; and Benj. Johnson, Kansas City.

Before the party sat down, Mr. Eveleth proposed a toast to the Kansas City hosts which received a hearty response.

At the conclusion of the luncheon, Mr. Kitchen told of the start of the Kansas City Chapter when it was found difficult to scare up the ten necessary members to sign the petition for a chapter. The chapter now boasts nearly 80 members and more are in sight.

Under the general chairmanship of John H. Kitchen, the principal committee chairman were: Ways and Means, Walter E. Gillham; finance, E. K. Campbell; publicity, B. F. Cook; automobiles, Benj. Natkin; reception, and entertainment, R. B. Johnson; special banquet committee, Dawson Campbell; hotel, J. B. Fehlig; golf, W. N. McIntyre; ladies', Mrs. John H. Kitchen, general chairman; reception, Mrs. Walter E. Gillham; luncheons, Mrs. L. A. Stephenson; musical program, Mrs. Dawson Campbell; automobile, Mrs. B. Natkin.



Lane Window-Leakage Testing Apparatus, Looking from Motor End

View of Lane Window-Leakage Testing Apparatus, Ready for Test

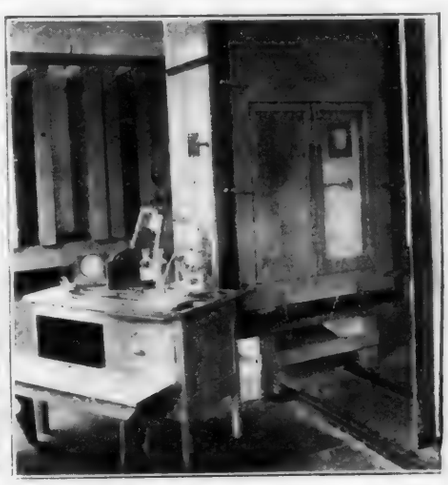
Trip to the Lane Research Laboratory.

On the way home from the convenvention a party composed of President Homer Addams, Secretary F. C. Houghten, Mr. and Mrs. L. A. Harding, Mr. and Mrs. E. B. Langenberg, Mr. and Mrs. Edward K. Lane, Professor and Mrs. A. C. Willard, Percy Nicholls and A. S. Armagnac, stopped off at St. Louis and were taken out to the plant of the Monarch Metal Products Company to inspect the research and testing room recently established there for studying window leakage under a wide variety of conditions.

The testing apparatus included a complete outfit modeled on that built by the Research Laboratory at Pittsburgh and, in addition, there were a number of small demonstration units, equipped with double-hung windows, casement windows, and single and double doors, which showed the various applications of the company's weather-stripping and also the comparative leakage of each type of window with and without weather-stripping.

President Lane of the Monarch Metal Products Company, came in for many complimentary expressions on his enterprise and progressiveness in providing such ample means for obtaining accurate engineering data on air leakage around windows, and on the effectiveness of modern weather-stripping.

The party were then taken to the neighboring warm-air furnace plant of the Haynes-Langenberg Mfg. Company.



View of Apparatus, Showing Inswinging Casement in Place and Testing Instruments

National District Heating Association

Optimism the Slogan of the Central Heating Men as Reports Are Received of Recent Important Advances in the Industry

IN an atmosphere of renewed optimism as to what the future holds in store for the central station heating industry, the National District Heating Association assembled for its fifteenth annual convention at the Hotel Commodore, New York, June 10-12. The convention proved one of the best in the history of the association. The committee reports and papers were unusually full of interest and drew extended discussions. The hospitality of the New York members was everywhere in evidence and, coupled with the many attractions which are always available in New York, made the stay of the visitors a delightful one from every angle.

O. W. Kastens, Grand Rapids, Mich.
The New President of the National District Heating Association

Opening Session, Tuesday Morning, June 10.

President F. B. Orr opened the convention and introduced President Hurd of the New York Steam Company, who extended the welcome of the New York members. Mr. Hurd pictured the central heating industry as having an unusually bright outlook, both from the standpoint of the industry and the banks. He urged the listing of steam securities on the stock market which, he said, would cause a favorable reaction upon the banking mind.

Secretary D. L. Gaskill, in his response, reviewed the progress of the industry from the time the association met in New York in 1916 up to the present time. Mired as the utility companies were in 1916 with low rates and high losses and a realization that the country would eventually enter the World War, the outlook was dark indeed. The war, he said, proved a blessing, however, as it enabled the utilities to raise their heating rates to a point where the industry could operate at a profit. This, together with the fascination of the utility business for the plain, honest, matter-of-fact business man, helped the industry to come into its own and the conditions have changed completely from one of pessimism in 1916 to one of optimism in 1924.

PRESIDENT'S ADDRESS

President Orr's address struck the same keynote. The association, he said, was looked down on by utility men and banks in 1916 while to-day both are looking to success. The heating industry, he pointed out, is showing great expansion. New York City, for instance, is greatly expanding the size of territory served. Pittsburgh has recently started the largest boiler in the world to supply steam to its heating customers. Cleveland is commencing an enormous development. Canada is following the heating business very closely and Winnipeg already has started a large installation. Battle Creek, Michigan, has just completed its large new heating plant. St. Louis is changing one of its large electric plants into a heating plant with many other signs of progress not mentioned.

This is perhaps the first year that these conditions can be shown and indicates that the heating industry now is a gainful occupation and not a weak sister to the electric business. The convention was then given the slogan of "Optimism."

SECRETARY-TREASURER'S REPORT

Secretary-Treasurer D. L. Gaskill reported that this has been the Association's most profitable year with a net balance of almost $700.00 and without a

cent of indebtedness. The total receipts were $9,364.00 and the expenses $8,682.00 leaving a balance of $682.00.

The membership of the Association now comprises two honorary members, 115 class A members, 94 class B members, 12 class C and 4 class D members, besides 34 associates, making a total of 286, a gain of seven members over last year.

There were 129 copies of the "Hand-book" sold during the year. Owing to cost of issuing new sheets the Handbook does not show a profit, but the return to the association in service and benefit is of great amount. It was advised in the report to issue a new edition of the Handbook after two years and not provide additional matter excepting the 40 pages which are now in print and which will be sent out within the next thirty days.

This report was the best the secretary has ever presented.

"We are in a new era of success," the report continued, "and I believe that the coming decade will be the most prosporous period of the association's existence and from its work will go out information that will be of incalculable benefit to all engaged in the heating industry."

Mr. Gaskill again expressed his appreciation of the assistance rendered him by the technical secretary, Mr. Wetherell, and credited him with much of the success of the association during the past year.

The advisability of publishing the Proceedings in the association's *Bulletin*, instead of in bound form, was included in the report indicating that the convention data could reach the members sooner and cheaper in the *Bulletin*.

Technical Secretary H. R. Wetherell made a brief report, giving details of the plans for the coming year in enlarging the scope of the association's *Bulletin* and in gathering data for the new edition of the Handbook. He presented the sheets issued during the year which will be distributed to all purchasers of the Handbook.

Secretary D. L. Gaskill reported for the executive committee, giving a review of its work during the year.

Reporting for the Educational Committee, Chairman J. H. Walker told in detail of the work done in adding to the Handbook, of the plans to have a new edition in two years and of the need of all members to gather new data at once for this edition.

Afternoon Session, June 10

The report of the Operating Statistics Committee, presented by J. C. Butler, chairman, contained data received through questionnaires mailed to heating companies throughout the United States. The information asked for was similar to that of last year, those companies doing water heating were furnished with a special questionnaire, a subject which was not covered last year.

Some of the principal data presented were as follows: the average transmission loss between boiler header and customer's meter was 19.6%. The average pounds of steam sold per ton of coal burned, 12,400 lbs.; per barrel of oil, 2,440 lbs., hogged fuel, per unit* 8,533 lbs. The evaporation per pound of fuel burned with coal was 6.13 lbs. and with oil, 7.4 lbs. The average connected load was 685,000 square foot of radiation with an average heating requirement of 498 lbs. of steam per year per square foot of radiation. The average income per square foot of radiation was $0.867. The theoretical efficiencies with coal, oil and hogged fuel were 54.8%, 42.0% and 51.5% respectively.

Twenty companies favored thermostatic control and four did not. Fourteen companies preferred welded piping while thirteen preferred screwed piping.

The hot water section received replies from seven companies having an average of 347 customers per company, with an average radiation demand of 925 sq. ft. each. The average radiation connected per ton of coal burned per season was 25.7 sq. ft. The average theoretical efficiency was 71%.

INDUSTRIAL DEMOCRACY

Dean Dexter S. Kimball, of Sibley College, Cornell University, Ithaca, N. Y., addressed the association on the subject of "Industrial Democracy." Dean Kimball always has a timely subject to present and delivers it so ably and completely that whoever hears him always leaves the meeting with much food for thought.

He showed that the problems of engineers in the future were not merely design and operation but that the industry in general is probably going to fall into the hands of the engineer instead of the business man. Only 25% of the engineers to-day follow technical pursuits, while the remaining 75% are working in administrative positions. He showed that most of the new material contributed to business in the last 25 years has been presented by the engineer.

Dean Kimball pointed out that there are many forms of democracy and each must have defined limitations to operate properly. He showed the change in business from the time when tools and industry were owned by the same man to the present time where men have grown away from work in the general field and now specialize in a definite highly-developed branch but even then do not own their own tools. This development has lead to a degree of discontent among the workers, even though the engineer has made life extremely comfortable and the opposite should prevail. To rectify this discontent has resulted in what is called "industrial democracy."

The discontent is caused by the envy of the rich which is always present; the removal of the tools of industry from labor; the fact that groups of industry are no longer masters of their destiny, and that men must be content not to do general work but merely a single detail.

Here the types of democracy were discussed and their application to industry defined. Several organizations modeled after our own government were described, showing only partial success. The ap-

*Unit consists of 200 cu. ft. of approximately 4000 lbs.

plication of any type of democracy in industry must have limitations. These limitations are necessary because of the need of expert advice which is not an elective function.

So a modified form of democracy similar to our government is necessary, with the laborer having a word in shop problems such as wages, rules and regulations, or anything with which he has intimate knowledge.

The address concluded with a summary of "Industrial Democracy." Intelligence, said Dean Kimball, is the life of industry; industry is for the people and not people for industry. Intelligence, however, cannot be elected. It is the rarest thing we have.

D. L. Gaskill, in discussing Dean Kimball's address, pointed out that as our industries have grown the personal touch between the management and employees has been lost. This, he said, is perhaps the fault of the public schools (not colleges) in that the students have not been taught the handling of people. He felt that the solution of the present discontent is in taking time to review the personal pride of the worker and to instill upon the younger generation in the public school methods to improve upon this personal pride and association in industry.

To apply this directly to the public utility he suggested courses in business fundamentals and utility problems in high schools and the selling of utility stock to the public to establish the personal equation between industry and the public or between management and the employees.

Morning Session, June 11.

The first professional paper of the convention was a discussion of "Steam Service Control" by William J. Baldwin Jr., of the New York Steam Company. The paper described a new type of temperature control. The main portions of this paper will be presented in an early issue of THE HEATING AND VENTILATING MAGAZINE.

There was a spirited discussion on the device. J. E. Seiter showed that while the savings effected were quite good yet the system supplied very little if as much as the unit thermostat. J. C. Hobbs compared this control with certain types of electric control but thought that if the control did not shut the steam supply completely off of the building better results would be obtained. This, of course, would complicate the piping arrangement. W. G. Carlton felt that many of these types of control on the system would effect the load factor to a marked extent and he was of the opinion that certain sections of the building might become chilled at times.

D. S. Boyden remarked that the savings made were good but did not furnish the true comparison required for an apparatus of this type. He suggested comparisons of saving effected with other types of temperature control. C. Lyford, of the Minneapolis Heat Regulator Company, felt that the additional cost of the apparatus compared with the simple unit thermostat was not warranted. J. C. Hobbs commented upon the value of the apparatus in permitting a higher pressure to be carried on the system, thus assuring better distribution.

J. E. Seiter remarked that tests have proven that savings made with any type of temperature control are made by keeping proper temperatures in the building. If the losses of the heated distribution systems are neglected and the building is heated to 70° continuously while occupied, the steam consumption will be the same regardless of whether this is accomplished by turning on and off the steam periodically or by leaving it on continuously. Shutting off the steam during half of the day should not necessarily reduce the steam consumption 50%.

Mr. Wetherell felt that the integration of recording flow meter charts with jagged curves such as are obtained with this type of system might result in considerable error and suggested tests on the device with condensation meters.

C. A. Gillham remarked that many types of control have their individual uses and greeted the new device as simply another means of reducing steam service costs.

REPORT OF HEAT UTILIZATION COMMITTEE

The Heat Utilization Committee Report, presented by J. E. Seiter, chairman, gave a very complete discussion of temperature control. The report was presented in six separate contributions of committee members. The first, a paper on "Temperature Control" discussed both manual and automatic temperature control and, more or less in detail, the use of the fixed orifice with variable pressure. The main portions of this paper are presented elsewhere in this issue.

The second paper showed very favorable results by using Minneapolis temperature control and results of tests run with and without this apparatus. A. D. Leach presented, in the third paper, a very complete analysis of unit thermostatic control in large buildings. The results obtained were described as a revelation to the committee and may open a new field for this apparatus.

Mr. Leach, in summing up the results, stated that a number of consumers who have installed thermostatic control are entirely satisfied, despite the fact that these have saved no money, but probably slightly increased their heating bills. They felt the investment they have made is worth while in the better service experienced and the elimination of bother with attendants or manual control.

His company believes in the principle of thermostatic control of the heating system in every building, he continued, but its belief is tempered by the knowledge that the following factors should be seriously considered before an installation is made.

1. Is a single unit practical? If not, is the expense of a system having individual room control warranted? The question can only be decided by an intimate knowledge of building tenants' requirements and the manner or way in which the direct radiation is installed. A structure in the hands of a careful operator, who does not have many duties

aside from the controlling of the heating system, can be frequently operated with less expense than can a building with thermostatic control.

2. Is reduction in the cost of heating the building the only consideration in the making of an investment in thermostatic control? Like the central station industry, thermostatic control has certain advantages which are not always recognized at first sight.

We feel that the decision in each case, he concluded, is of necessity, individual, and that no general statement can be issued as to the desirability or otherwise, of this equipment, except that we feel that it is right in principle.

In discussing the report Mr. Woodward showed the development from thermostatic control on installations with flat rates 30 years ago and the use of orifices after the air lines to the thermostats became plugged, to the time when all control was abandoned. He remarked that with the new system of orifice control with varied pressure we have reached the peak of the sine curve of temperature control. He pointed out that economical operation depended upon time and temperature control, good installations of heating systems, proper instruction as to its operation and co-operation of the heating company.

Mr. Walker remarked that the tests of over and under radiation only applied with thermostatic control and that absolutely contrary results might be obtained without this control. O. W. Kastens showed that only one type of modulating valve was designed with a proper area for usual pressure conditions and consequently fractional heating of radiators was not obtainable by setting the ordinary modulating valve.

Mr. Wetherell felt that the orifice system needed more attention than other types of temperature control and thought that if pressures were varied on the atmospheric system similar results could be obtained.

J. A. Donnelly pointed out the value of field research. In his observations of systems using the fixed orifice he noticed the ease with which the heat diffused through the walls and floors, thus minimizing the effects of any slight error in sizing the orifices.

Mr. Hillis, of the American District Steam Company, commented on the results shown in Peoria, Ill. He stated that the system there was designed for economy both for the user and seller and with proper operation should show much better results. The atmospheric system is the outgrowth of the days when steam was sold on a flat-rate basis and it was of prime importance to keep the consumption at a minimum. He cited cases where savings as high as 43% were obtained with this system.

A. B. Holley, of the Metering Bushing Sales Company, pointed out that single-pipe jobs proved very extravagent but, due to the cost of hot water radiation, it was expensive to change from straight steam to vapor systems. To eliminate the change in radiation the metering bushing was designed. The entire velocity of the steam while passing the restriction is taken up in the bushing and directed into the first section, thus assuring heat in the first sections of steam radiators. He showed that installations with these bushings are made with return temperatures below 140° F. at 30° below zero.

Mr. Lyford showed results in large buildings in Seattle, Washington, being controlled very satisfactorily with unit thermostat equipment.

Afternoon Session, June 11.

The principal speaker of the afternoon was E. B. Ricketts, of the New York Steam Company. Mr. Ricketts spoke of the operation of steam boiler plants. He forcefully brought out the point that efficient boiler plants are not made in the drafting room but that intelligent effort to produce the desired results is constantly put forth by the operators.

In commenting upon the basis of good boiler operation Mr. Ricketts stated that a thorough knowledge on the part of all the men in the plant of the materials and apparatus with which they must deal, and the thorough and consistent co-operation of management and men in the common aim of stopping all leaks and keeping them stopped was of vital importance.

Among the factors to accomplish this result he discussed the human factor, the choice of fuel, proper maintenance of apparatus, and clean heating surface.

The human factor, he continued, can be kept high if rivalry between shifts or plants is maintained in a fashion which the boiler room man can understand. Boiler room instruments are useful if kept in calibration and if understood by the operators. They should not be installed, he stated, simply as a check upon the men. The intelligent choice of fuel, Mr. Ricketts stated, was only possible through a careful study by chemists and the winner picked by actual boiler test.

The proper maintenance of apparatus is very important and operators are frequently blamed for poor results when, due to a shortsighted policy on the part of the management, such things as stokers, dampers, baffles, settings, etc., are allowed to get in such a state of disrepair that good results are impossible.

Mr. Ricketts showed the value of clean heating surface. He preferred the hand lance for the most thorough cleaning. The hand scale, he stated, can only be removed by wetting down the tubes and while wet to turn hot water into the boiler.

In conclusion Mr. Ricketts said the efficiency of our boiler plants rests in a very large measure with the man behind the shovel. The fireman would be happier working for high efficiency than he is working for six o'clock and pay day. Will you show him how?

REPORT OF STATION OPERATING COMMITTEE

J. C. Hobbs reported for the Station Operation Committee. The report, in general, covered the same ground in a similar manner as Mr. Ricketts' address. In conclusion Mr. Hobbs described the installation of the largest boiler in the world at

Pittsburg. Among the interesting things brought out in the discussion was the low flue gas temperatures obtained with this boiler and the high CO_2 which resulted in being able to carry higher ratings and thus increase the capacity. With the water-cooled furnace linings CO_2 or refractories are not the limits on the rating as in many cases. The low flue gas temperatures make economizers unjustifiable in this plant.

R. G. Felger stated that in usual boiler operation high percentages of CO_2 are not obtainable with high ratings.

E. E. Dubry took exception to Mr. Rickett's statement that boiler instruments are not as valuable as they are very often considered. He found from his experience the more boiler instruments the better the operation.

Morning Session June 12

A paper on "The Effect of Wind on the Heat Transmission of Building Walls, Glass and Roof," by A. C. Willard, was read by Mr. Wetherell. The problem was summarized in the general statement which read:

In preparing the "Code on Minimum Requirements for Estimating the Heat Required for Warming Buildings" for the American Society of Heating and Ventilating Engineers, the committee in charge of this matter was confronted with the problem of making suitable allowance for wind movement as affecting (1) the transmission of heat through building walls and glass, and (2) the infiltration (inleakage) of cold air through the cracks around doors and windows, and even through the building materials themselves, where such materials are at all porous. The present paper deals only with the first item, the effect of wind on the heat transmission of walls, glass, and roof.

Since the proposed code was to apply to the entire country, it was evident that whatever method was presented for arriving at the wall, glass, and roof transmission coefficients, the method adopted must provide for a wide range of wind velocities varying, of course, with the locality in which the building was located. At first glance, it appeared possible to establish, either by test or by calculation from the fundamental equations for heat transmission coefficients, a set of values based on still air which could be corrected by a simple multiplier to fit any given condition of wind velocity which might exist. These multipliers were to be (supposedly) some function of the wind velocity and could be presented in a table or a curve. Such a scheme would certainly be simple, but a little consideration of the nature of the expression for the coefficient of heat transmission for a wall shows that no constant correction factor for wind movement can be found even for a single locality unless all walls, glass, and roof have exactly the same coefficient of heat transmission when standing in still air.

Here Professor Willard went into detail showing the nature of the heat transmission coefficient, evolving formulae and giving values for the surface coefficients under both still air and various wind conditions.

The session concluded with the reports of the Distribution Committee and the Rates Committee.

Afternoon Session, June 12

The following officers were elected for the coming year:

President, O. W. Kastens, Grand Rapids, Mich.
First vice-president, C. A. Gillham, New York.
Second vice-president, J. E. Seiter, Detroit, Mich.
Third vice-president, G. W. Wright, Baltimore, Md.
Secretary-treasurer, D. L. Gaskill, Greenville, O.
Technical Secretary, H. R. Wetherell, Peoria, Ill.
Executive Committee members: H. A. Woodworth, St. Louis, Mo.; F. B. Orr, Chicago, Ill.

The Corrosion Committee, a new committee this year, presented what was characterized as a valuable contribution to the heating industry. The report was presented by J. H. Walker, chairman. He stated that while the fundamental principles of corrosion are fairly well established, certain problems peculiar to central heating systems have not been fully investigated.

The report covered only interior corrosion of apparatus and piping. To prevent or mitigate internal corrosion there are three general methods which have been followed: exterior-protective coatings, improved materials, and water treatment. These have proven impracticable or insufficient in many cases. Intelligent treatment of boiler water to render it and the steam generated non-corrosive is probably the most practical and effective way of eliminating corrosion.

In discussing corrosion in boiler plants and distribution systems the report points out that the water is usually made inactive either by deaeration or deactivation. Each of these processes were described.

The corrosion in customer's heating systems is more difficult to control, the report states, due to electrolysis, filtration of air into the piping systems and other local sources. From the chairman's experience in certain buildings in which corrosion was very troublesome certain problems presented themselves, viz., does condensation become corrosive through the absorption of oxygen? Do vacuum systems tend to promote corrosion? Does carbon dioxide tend to accelerate corrision?

In an endeavor to solve these questions tests were run in several buildings. The results of these tests showed that condensation does absorb oxygen sufficient to become slightly corrosive. CO_2 in the condensation at the entrance point was greater than at the discharge point, but this did not indicate its dissipation by corrosive action, as the amount of CO_2 water can hold is dependent upon its temperature and partial pressure of the gas above the water and these conditions are such that less dissolved CO_2 would be expected at the discharge end. Owing to somewhat contradictory findings no definite conclusion could be drawn as to the relation of corrosion to the different types of systems.

The action of CO_2 in the steam upon the piping by direct acid action was not found to be likely.

This concluded the convention.

Market Remains Undecided

Readjustment Has Forced Low Pressure. General Condition Healthy

Especially Prepared for THE HEATING AND VENTILATING MAGAZINE

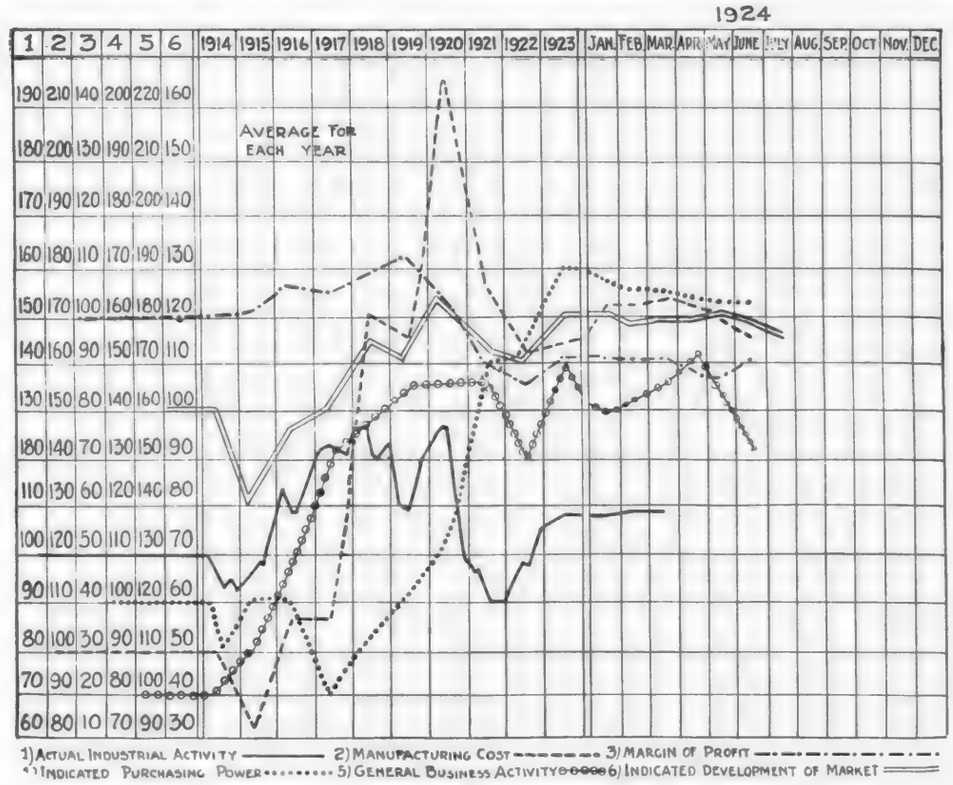
By L. W. Alwyn-Schmidt

THE month of June has brought no appreciable change in the situation of the market, which remains unsettled, with no indications for an immediate change. The unseasonable weather, no doubt, is responsible in part for this condition, as is the internal political condition, aggravated by the strained relations between the President and Congress. But the uncertainty of the tax situation has been removed by the somewhat belated action of Congress and a considerable amount of money is set free in this manner, which may be used now for personal expenditures. It will help to increase the volumn of retail purchases.

But unsatisfactory as the situation appears at the present moment there is noticable a tendency, on the side of those best able to judge, not to let themselves be stampeded into a state of pessimism. In fact, the market is more optimistic to-day than might be expected under the existing circumstances. This optimism is caused by the knowledge of the security of the economic structure of the market, and the general confidence in the soundness of business. That money is plenty and cheap and that banks are willing to come to the aid of commercial enterprise certainly is a helpful factor. Indications are that the stringency of cash, which has been so predominant a feature of the last six months, is ended. Retailer, jobber and manufacturer alike have come to a point where settlements can be made without danger to their credit holdings in the banks. This must have a beneficial influence upon the credit situation of the market as it will permit the market to enter the autumn season better prepared, than was the case at the beginning of the Spring season.

The last half year, no doubt, has been one of general adjustment, a condition which always must be accompanied by more or less violent fluctuations of the market. It is not confined to the American market alone, but affects business also in most other markets, especially those of the leading industrial European countries and, to a lesser extent, those of South America and the British colonies. As readjustment proceeds a shifting is noticeable in the corresponding relationship of such fundamental market factors as cost of production, wages and general price situation, affecting, in turn, the purchasing power of the individual consumer and the monetary situation in general. Readjustment in such a case is nothing else but the desire to establish a new and, if possible, permanent level of each and every economic factor until a completely new relationship satisfactory to producer and consumer has been established.

In our own instance, a reduction in manufacturing profits has taken place, caused originally by a rapid increase in industrial wages, not counteracted sufficiently by a corresponding increase in the price of the manufactured article. In addition, high overhead and distribution costs have raised the cost of the industrial product to the manufacturer. This resulted in price levels which made it unprofitable for the wage earner to buy commodities and more profitable to invest his wages in savings banks, insurance or in permanent additions to his fortune, as the purchase of real estate and homes. Industry has persistently tried to correct this tendency by cutting at first profits and, later, at the cost of production itself. The attempt has not been particularly successful, with the result that production cost has remained high all through the present year, showing a slight decline only



Analysis of Business Conditions at End of June

during the last months. This decline, however, has been put to good service and notwithstanding a further slight reduction in the general commodity price situation, there can be seen an improvement in the scale of industrial profits, indicating that the industrial producer is able to protect his interests to-day better than before.

Not sufficient attention, however, is paid to the employment situation. Industrial employment has been very even during the whole of the preceding year, showing hardly any seasonal deflection. During this year manufacturers have been more careful in their labor policy and less men are carried on the wage rolls during the present summer season. While this can not be properly called "unemployment", there is no denying the fact that the present occupation figures in most industries are coming dangerously near the levels of the pre-war period.

But even taking into consideration this aspect of the situation, there is no reason for alarm. The present decline follows a period of high economic activity very favorable to the wage earner as it has enabled him to accumulate credits, now available for his running expenses. There is, in consequence, no real buying slump. On the contrary, retail business, although retarded, operates at satisfactory levels in all the articles required for every-day consumption. There are no bread lines and none are to be expected, unless the unforeseen should happen. The wage earner and salaried men will be able to finance themselves until the recovery comes.

In the meantime, the caution counselled early this year should not turn into over-cautiousness. Careful buying and manufacturing, which is a commercial virtue when exercised within reason, may easily be a vice when overdone. It deprives business of its principle asset, that of having on hand a stock for the willing purchasers to select from.

There is evidence that the lowest point of the present depression has been reached or is immediately ahead. The recovery, when it comes, will be speedy and it is naturally the merchant who has foreseen its coming who will best be able to take care of the new chance.

Adoption of Simplified Practice Recommendation for Hot-Water Storage Tanks

After a series of conferences in which manufacturers, distributors and users participated, the United States Department of Commerce, through its Bureau of Standards, has published its recommendation, under date of June 13, 1924, that recognized sizes and varieties of hot-water storage tanks be reduced to the following:

Diameter* in inches	Length* in feet	Actual Capacity In U. S. gallons
20	5	82
24	5	118
24	6	141
30	6	220
30	8	294
36	6	318
36	8	423
42	7	504
42	8	576
42	10	720
42	14	1,008
48	10	940
48	16	1,504
48	20	1,880

* By diameter is meant inside diameter; length means length of sheet, not overall length of tank.

Under "Working Pressures, Classification and Marking," it is provided that these sizes be made in two working pressures, 65 lbs. and 100 lbs. per square inch. Those made for 65 lbs. working pressure are to be classified as "standard," and those for 100 lbs. as "extra heavy." Each tank is to be stenciled with its proper classification, working pressure and name and address of its manufacturer.

Factors of safety, thicknesses, etc., are to be in accord with the A.S.M.E. code for "Non-Fired Pressure Vessels." The tanks as listed are to be made interchangeable for either horizontal or vertical installation.

There are to be six tappings on each tank, one in the center of the convex head, two in the shell, in line, each to be centered 12 in. from the edge of the sheet; and three in the shell, in line, diametrically opposite from the line of the two just mentioned. Of these three, one is to be centered 12 in. from the convex end, another, 12 in. from that end, and the third, 12 in. from the concave end. All measurements are taken from the edge of the sheet. There is no tapping in the concave, or bottom, end.

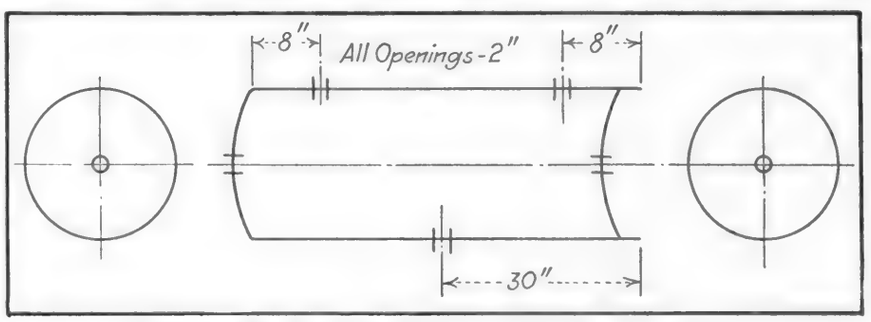
All tappings in tanks up to, but not including, 30 in. in diameter, are to be 1½ in.; from 30 in. up to, but not including, 48 in., 2 in.; and from 48 in. upward, 3 in. These tappings apply to either horizontal or vertical installations.

Manholes are to be standard size 11 in. x 15 in. and may be placed either in the shell or head. Handholes are to be 4 in. x 6 in., located as desired.

Heating coils for either horizontal or vertical installation of these tanks must not be less in size or total length than as here stated.

Tank dimensions: Diameter In.	Tank dimensions: Length Ft.	Size of pipe in inches	Number of lineal minimum feet of pipe Allowed
20	5	1	14
24	5	1¼	14
24	6	1¼	18
30	6	1¼	18
30	8	1¼	28
36	6	1½	18
36	8	1½	28
42	7	1½	22
42	8	1½	26
42	8	1½	34
42	14	1½	50
48	10	2	34
48	16	2	58
48	20	2	74

These recommendations become effective January 1, 1925.



Proposed Standard Tappings for Hot Water Tanks

Winning Slogan for Garage Heater.

The winner of the slogan contest, conducted in THE HEATING AND VENTILATING MAGAZINE by the Evenheat Mfg. Co., 552-554 West Adams St., Chicago, Ill., in connection with its new gas-fired hot water garage heater, is J. Thompson, of Morgan Park, Ill. Mr. Thompson's slogan, which was adjudged the best of those submitted, is

"HE WHO HEATS; EVENHEATS."

In accordance with the conditions of the contest, Mr. Thompson has been awarded a complete Evenheat gas-fired hot water garage heater, valued at $140.00.

All-Electric Apartment Houses

The Security Apartments being erected in Hollywood, Calif., are to be equipped with the latest electrical products, including electric refrigerator, electric range, combination sink and electric dish-washer, electrode water heater for each apartment and, in addition, the general heating system for entire building is to be electric. E. M. Frazier, of Los Angeles, is the architect.

The Argument for Air Admission Above the Fuel Bed as the Solution of the Combustion Problem

By Walter S. Timmis
Consulting Engineer.

Everyone knows that air (oxygen) is necessary for combustion. In the case of an automobile, if the carburetor is not adjusted so as to admit the correct proportion of air, the engine does not run properly, fuel is wasted and there is no smooth flow of power. Accurate air adjustment here is the key to high efficiency.

The Welsbach gas light affords another example. If too little air is admitted, the flome is smoky, if too much, the flame blows. Only the RIGHT amount of air will insure the maximum amount of heat and brilliancy.

The common gas stove affords a third example. This is always equipped with an air-mixing device which insures the proper mixture of air and gas, and hence, a blue flame and maximum heat.

The above are all problems in combustion which have been met and solved.

In the case of the carburetor, the Welsbach mantle and the gas range, care is taken to recognize the necessity for this correct air mixture and if it is kept in mind that boiler furnaces are nothing more than gas producing plants, the need for this same secondary air mixture will at once become apparent.

BOILER FURNACE PRIMARILY A GAS PRODUCER

To quote from the technical works of the United States Bureau of Mines:

"In a hand-fired furnace, about one-half of the combustion takes place in the fuel bed, and one-half in the combustion space. The burning fuel bed acts principally as a gas producer and a gas retort; in it the solid fuel is gasified by the partial combustion of the fixed carbon and by the distillation of the volatile matter. The gases rising from the fuel bed contain at times as much as 32% combustible and no free oxygen to burn it. Hence, to burn these gases, air must be admitted over the fuel bed and mixed with the combustible, and the mixture burned in the combustion space."—*Technical Paper* 139, p. 7.

Thus we may observe that the correctly-controlled scientific introduction of air to these gases is just as absolute a necessity as it is in the case of the Welsbach mantle or gas range above referred to.

AIR INTRODUCTION OVER FIRE LONG ADVOCATED

Such air introduction over the fire has been advocated for a number of years, the Bureau of Mines having forcefully called to the attention of coal consumers through its technical papers and bulletins the beneficial results to be obtained through the introduction at the right point in the boiler furnace of air in proper quantities, properly admitted to the combustion chamber in a large number of fine streams.

Examples of the Bureau of Mines findings in this field are presented in the following quotations:

"Of the air necessary for complete combustion of the fuel only about one-half can be supplied through the grate; the other half must be supplied above the fuel bed. If an attempt is made to force more than this amount of air through the grate, only the rate of gasification of coal in the fuel bed is increased, while the degree of completeness of combustion as indicated by the combustion of the gases leaving the fuel bed, remains the same. The combustion can be completed only in the combustion space by adding enough air over the fuel bed and mixing it with the combustible. In other words, the process in the fuel bed determines the rate and the process in the combustion space the completeness of the combustion. In a general way, it can be said that in burning coal one-half of the combustion takes place in the fuel bed and one-half in the combustion space."—*Technical Paper* 139, p. 7.

"The fuel bed, then, acts as a gas producer and its object seems to be to gasify the solid fuel. A bed just thick enough to produce a maximum of CO_2 would be too thin to be practical."—*Technical Paper* 139, p. 33.

"Additional air must always be introduced over the fire in such a manner that it will mix with the combustible gases, otherwise a large percentage of these will escape unburned."—*Technical Paper* 137, p. 52.

"The ideal way to supply additional air over the fire is to introduce it as close to the fuel bed and in as large a number of small streams as possible."—*Technical Paper* 137, p. 55.

The difficulty has been in perfecting a device that would do these things. Many have been offered to the public without any just claim to merit and only the most exhaustive scientific research and practical experimental work has finally led to the solution of the problem for accomplishing the proper introduction of this secondary air supply.

Combustion, to be most economical, must be complete at all rates and particularly it must be complete during the period of small load. The least amount of draft that will carry the load and still give complete combustion is the best draft to carry.

FUNDAMENTAL REQUIREMENTS WITH BLOWER EQUIPMENT

The ability to use small sizes of anthracite coal results, as is well known, in practically cutting in two the consumer's coal bill for, whereas the price of egg, stove and nut coal has frequently run as high as $16.00 per ton in the New York district, the cost of pea and buckwheat coal has probably not averaged over $8.00 per ton. To enable the consumer to burn these smaller sizes, the use of blowers has been widely advertised.

It is a recognized fact that blowing air through a fuel bed of proper depth cannot effect compete combustion, since the more rapidly the air is blown through, the more rapidly the fuel bed gasifies, the analysis at the surface of the fuel bed of the gases generated remaining practically unchanged. This fact is again attested to by no less an authority than the U. S. Bureau of Mines. If complete combustion is to take place under such conditions, it is absolutely imperative that proper introduction of air over the fuel bed be provided for.

To quote from the Bureau of Mines Technical Paper 137 on this subject:

"By increasing the rate of feeding air only the rate of combustion is increased and not the weight of air used per pound of combustible. It is, therefore, impossible to regulate the excess of air in any hand-fired furnace by increasing or decreasing the flow of air through a level fuel bed; only the rate of combustion can be controlled thereby."

"As the gases rising from the fuel bed contain a higher percentage of combustible and no free oxygen, and as the air supply per pound of fuel can not be increased by increasing the rate of air supply through the fuel bed, it is apparent that to obtain complete combustion some air must be added over the fuel bed."

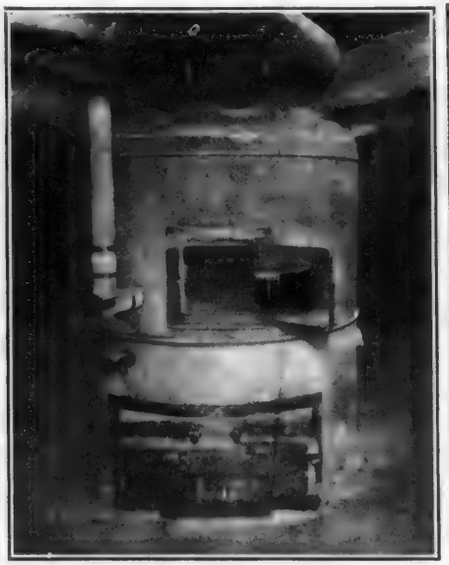
"It is well to state in this connection that forced-draft apparatus cannot supply enough air through a level fuel bed to insure complete combustion. Additional air must always be introduced over the fire in such a manner that it will mix with the combustible gases, otherwise a large percentage of these escapes unburned.—*Technical Paper* 137, p. 51-52.

The practice of introducing air under pressure below the fuel bed is one which can be successfully put into practice only after a careful study of furnace draft conditions, since the introduction of air improperly carried out wastes and clinkers the coal.

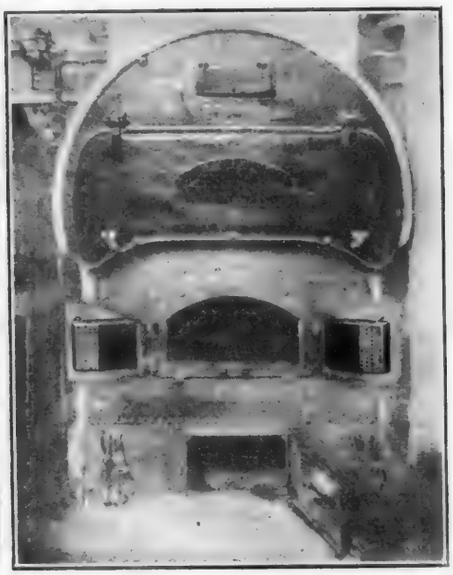
The introduction of air properly controlled and distributed above the fuel-bed on the blower-equipped plant is effective in securing combustion of the gases generated. The required heat is obtained from the natural gas from the fuel bed, burned with the necessary secondary air mixture, hence the frequency of the blower's operation is reduced, with resultant economy of fuel.

Numerous instances have been noted where the use of an air-admission device has reduced the operation of blower-equipped plants in homes and other buildings from every 30 to 60 minutes to two or three times a day, with resultant economies in fuel, reduction of ash and clinker and elimination of coal gas, the latter being one of the chief sources of complaint with the blower-equipped plant.

Round Cast-Iron Boiler in Office Building of F. H. & A. H. Chappell Co., New London, Conn.



Warm-Air Furnace in Home of Walter S. Timmis, Jamaica, N. Y.



One of Three Firebox Tubular Boilers in Gotham National Bank Building, Columbus Circle, New York

Typical Installations of Combusto Draft System

With this method, equally successful results have been obtained on down-draft boilers of all types, on boilers specifically adapted for the burning of soft coal, on firebox tubular boilers, on magazine-feed boilers and on horizontal and vertical heating boilers.

Some first-hand experience with an air-admission device are reported by Mr. Timmis, in connection with an installation in his own home. As will be seen from the accompanying illustration, the appliance used is attached to the feed door of his heater. It is in the form of a cast-iron cellular box. The air is heated on passing through this structure and is then discharged through a number of small apertures over the fire bed. The amount of air admitted is carefully computed for the required conditions.

Prior to the installation, this furnace, reports Mr. Timmis, was regularly fired at 6:30 A.M., and several times during the day and at 9:30 P.M. He was burning egg coal, being unable to burn successfully any smaller size and it was not possible to secure sufficiently complete combustion to prevent unburned coal from dropping into the ashpit and an undue amount of clinkers.

After the installation he reports that the first early morning firing held an even heat throughout the day until the banking period at night. He soon found that he could burn 50% pea coal with success and the coal was satisfactorily burned, leaving a fine white ash. The house was heated more evenly than before, and there was at least one-third less ash to remove. He estimates the economy of fuel at 25%.

Mr. Timmis attributes the successful operation of this device to the manner in which the secondary air supply is introduced.

"Perhaps the most important feature of this device," states Mr. Timmis, "is the resistance to the flow of air through the apparatus itself, which is made to equal the resistance of the fuel bed. In this way it is possible to obtain a balanced condition above and below and through the fuel bed, a fundamental requirement for correct and economical combustion.

New Regulations For the Installation of Blower and Exhaust Systems

(Continued from the June Issue)

Systems for the Removal of Flammable Vapors

WHILE the functions of these systems in a general way are similar to those of ventilating systems, the extremely hazardous nature of the vapors to be removed necessitates certain departures from the requirements for heating and ventilating systems.

(In addition to the specific requirements for this class the general requirements apply).

Fans

Note: Fans are liable to constitute a hazard, and their use in hazardous locations should be avoided wherever possible. When they must be used in such locations the following regulations apply.

The capacity of the fans used and the motive power employed must be ample to meet all requirements without the necessity of over-speeding, and to effect a proper, complete and continuous change of air. The fans must be constructed throughout of non-ferrous materials. The bearings must not extend into the housings or casings, nor into the ducts. Fans cannot be located in walls. Unless placed outside of the building, they must be located within the rooms or areas from which flammable vapors are being removed, or in a fire-proof compartment within these rooms or areas, and they must be located outside the path of vapor travel. They must never be placed in rooms used for different purposes or occupancies.

When vapors heavier than air are to be removed, the fans must be located not less than 6 ft. above the floor level and preferably close to the ceiling. When vapors lighter than air are to be removed, the exhaust fans must be located at a lower level than that at which the vapors originate. The inlets of the suction ducts of the exhausters, it is noted, should be located at the different points of the rooms from which the vapors are to be removed.

Blowers must not be used for delivering air into rooms or areas communicating with any other portion of the building from which flammable vapors heavier than air are to be removed. They may be located outside of such rooms, provided, however, the discharge inlets into these rooms are well above the floor level; not less than 6 ft. When such blower discharges pass through fire walls or fire partitions, the openings must be protected in an approved manner.

When blowers are used for removing vapors as light as or lighter than air, they may be within the room or area; in that case, however, they must be constructed throughout of non-ferrous materials.

Ducts

Ducts must be constructed of non-combustible materials. They must be independent structures, and not built in the walls. Exhaust ducts shall lead to the outside of the buildings as di-

rectly as possible, never through other rooms.

The outlets must be kept clear of and away from any combustible materials, and be protected and guarded against exposures by reliable fire-screens. The inlets, whether near the floor or near the ceiling, must be flared or funnel shaped. Those at or near the floor must be protected by substantial wire screens of not more than ½-in. mesh.

Dampers, valves or shutters must not be placed within the ducts or at the inlets or outlets of the ducts. Ducts must be free from pockets or traps.

When hoods are used for the removal of flammable vapors from special points or apparatus, they must be constructed of non-combustible materials throughout. The connections between the hoods and the ventilating ducts must be at the highest points of the hoods, and of a size not less than that of the connecting ducts, preferably larger, with reducing connections to the ducts.

Power

Motors, if used, should preferably be located outside of the rooms from which the vapors are to be removed. If permitted in these rooms they must be of the squirrel cage or totally enclosed type, and located outside the path of vapor travel.

Switches, fuses and circuit breakers controlling the circuits must, if possible, be located outside of the rooms from which the vapors are to be removed. If these appliances are within the rooms they must be located outside the path of vapor travel and shall be of the totally-enclosed type. Preferably circuit breakers of the oil immersed type should be used.

Remote control must be provided in all cases (in addition to any control that may be provided within the rooms).

Grounding

All metal parts of apparatus used in systems for removal of flammable vapors, including fans, ducts, etc., as well as shafting in connection therewith, must be electrically grounded in an effective manner.

Wherever satisfactory metallic contact cannot be effected or maintained at joints or between different portions of the apparatus, so as to insure an uninterrupted electrical connection to "ground," copper bonds, properly and securely attached, must be provided.

Belts shall be grounded by means of copper collectors or "combs" connected to heavy insulated wires carried to "ground."

(To be continued)

Standard Specifications for Cast-Iron Pipes Being Compiled

At a conference in New York, June 5, it was decided that there should be undertaken a general program of unifying existing specifications for cast-iron pipe into a consistent set of nationally-recognized specifications, according to an announcement of the American Engineering Standards Committee.

Consideration of the subject was introduced by a comprehensive paper by W. G. Hammerstrom, which outlined the present practice, including that of various organizations which have issued formal specifications, and indicated the more usual commercial departures from and extensions of these standards.

It was agreed to arrange the scope of the work to include unification and development of specifications for cast-iron pipe, including materials, dimensions, pressure ratings, methods of manufacture including such new developments as centrifugal casting, insofar as they may be necessary to secure satisfactory results in preparation of workable specifications; elimination of unnecessary sizes and varieties, consideration of the possibility of developing a co-ordinated scheme of metallic pipe and fittings applicable to all common mediums (possibly along the lines of the work being carried on in Europe on the same subject), and methods of making up joints insofar as they are determining as to the dimensional design of cast-iron pipe.

The types of cast-iron pipe under standardization are to include: (a) flanged pipe; (b) flanged and bell mouth fittings and wall castings; (c) pipe elbows, tees, Y's, return bends and other fittings not now included in standard lists; (d) cast-iron pipe threaded for flanges or couplings; (e) soil pipe and other light types of cast-iron pipe and fittings.

The work will be co-ordinated with that of the existing sectional committee on pipe and flanges, which is already well advanced under the sponsorship of the American Society of Mechanical Engineers, the Manufacturers' Standardization Society of the Valve and Fittings Industry and the Heating and Piping Contractors' National Association.

It was recommended that the work be carried out by a sectional committee under the auspices and procedure of the American Engineering Standards Committee, and under the joint sponsorship of the American Gas Association, the American Water-Works Association, and the American Society for Testing Materials. This recommendation was later adopted by the A. E. S. C.

New Officials of the Heating and Piping Contractors' National Association

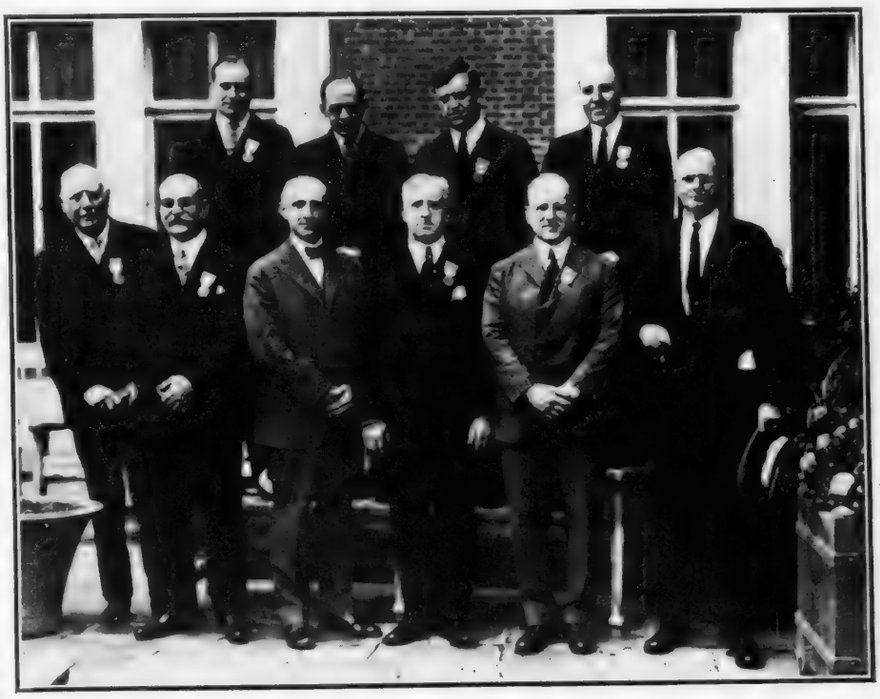
The accompanying group photograph of the new officers and directors of the Heating and Piping Contractors' National Association was taken directly following the close of the association's recent annual convention in Atlantic City. Those appearing in the group are:

Top row, left to right: R. Templeton Smith, Pittsburgh; Mortimer L. Crowell, Cleveland; Joseph H. Volk, Milwaukee; and Harry M. Hart, Chicago.

Bottom row, left to right: Sergeant-at-arms John T. Bradley, St. Louis; Secretary Henry B. Gombers, New York; Treasurer Horace W. Jones, Rochester, N. Y.; President Frank A. Merrill, Boston; Vice-President William H. Driscoll, New York; and William M. Anderson, Philadelphia.

Important Resolution Adopted by Heating Contractors on Boiler Ratings

In addition to the resolution on standardization of methods of figuring radiation, adopted by the Heating and



New Officials of the Heating and Piping Contractors' National Association

Piping Contractors' National Association at its recent annual convention, and reported in THE HEATING AND VENTILATING MAGAZINE last month, a resolution was also adopted on the boiler-rating question which indicates a determined effort to get at the bottom of the subject. The resolution is as follows:

Resolved, that the inconvenience and loss caused our members and the public through the uncertainty of boiler ratings calls for immediate action. With this in mind, be it further resolved, that the committee, already appointed to meet with the National Boiler and Radiator Manufacturers' Association and the American Society of Heating and Ventilating Engineers, be given every possible assistance in order that, at an early date, they may be able to establish reasonable and uniform methods of determining boiler capacities under average installation conditions."

American Construction Council on Building Situation

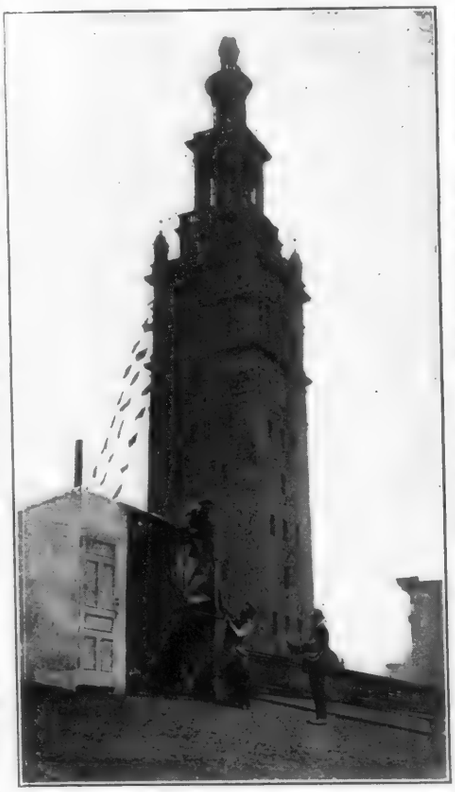
There is no need of a warning against excessive building activity, such as was issued a year ago, in the opinion of the American Construction Council, of which Franklin D. Roosevelt is president. A survey discloses, it is announced, that while general business has fallen off somewhat, construction has held up and a large volume of construction is now under way. However, it is felt, there is little danger of a building boom as the industry is fairly well stabilized and many big builders have taken the council's advice as to winter construction plans.

The council has found, however, that much of the recent building has been faulty, both in construction and in financing. "Thousands of structures now under way or recently erected" Mr. Roosevelt states, "especially in housing, are subject to such rapid deterioration that within ten years' time, sometimes less, they will be practically valueless."

So seriously does the council regard this phase of the situation that a special committee has been named to conduct a survey and report back with recommendations.

"The situation has resulted" Mr. Roosevelt declares "from the activities of irresponsible groups found in every element of the industry. Faulty engineering, unreliable architects, inexperienced and incompetent contractors, inferior grades of material, poor mechanics, inadequate and poor inspection, and other bad factors frequently enter into building work. These have serious effects but none more serious than unsound financing. Mortgage bonds are issued and on speculative buildings. Many such issues are based on improper security and fictitious statements of earnings at abnormal interest rates. They find buyers because of the general ignorance existing in many quarters as to the requirements for good real estate securities. Such purchasers are usually those who can least afford to be victimized."

Mr. Roosevelt announced that the council is progressing nicely with its plans for the training of apprentices and the development of improved craftsmanship in the building trades.



One of the Four 12-Ft. Fans Installed at Madison Square Garden to Keep Cool the Delegates to the National Democratic Convention

The Spring Season of 1924

BY G. J. O'CONNOR

From the viewpoint of the normal temperature, May, which is the concluding month, in some sections, of the heating season, was the coolest month of the past winter. This is true of all the weather stations included in the accompanying table. It is further attested by comparison with the lowest mean temperature for May. Comparison is also made with records at these stations in 1917, which most people interested in weather lore will long remember as one of the coldest years of record.

U. S. WEATHER RECORDS

MONTHLY MEAN TEMPERATURE FOR MAY, DEG. F.

	New York	Boston	Pittsburgh	Chicago	St. Louis
1924	56	56	55	54	59
1917	53	51	55	53	61
Lowest ever	53	51	55	51	59
Highest ever	65	63	70	66	73
Normal	61	57	62	58	67

As these records cover a period of more than fifty years, the amplitude of variation from the normal mean, which is also shown in this table, does not warrant any assumption of a change in climate, especially not to a milder climate.

The climate does not change. Only the weather does; and this by reason of the unequal distribution of the atmosphere over the earth. The atmosphere is a subtle gaseous fluid, tossing about everywhere and all the time, causing unaccountable variations in atmospheric pressure, with marked depressions here and notable elevations elsewhere.

In this respect the past Spring witnessed some strange phenomena. March seemed submerged, as it were, far beneath the sea-level measurement of the aerial ocean. The normal stage of the barometer at sea-level is 30.03 in. The mean barometric pressure for March was the lowest of record in many parts of the country between the Plains States of the west and the Atlantic seaboard. It was 29.78 in. at New York City.

May was characterized by a similar depression, the mean barometer being 29.85 in. A ridge (though still submerged) of higher pressure tarried over the country during April when it attained 29.96 in.; thus making the average barometric pressure only 29.86 in. for the Spring.

We are wont to associate mild temperatures with atmospheric depressions and cold weather with "highs." This was true of March, but not of April or May. There was a notable absence of cyclonic and anti-cyclonic waves in all these months, a sluggish condition of atmosphere prevailing throughout. Northerly winds inland and off-water breezes in coastal States caused low temperatures by night. The predominance of cloudy days, frequently with rain, accounted for the shutting off of sunlight heat by day. These damp and chilly days and nights continued unabated until we were "knee deep" in June.

Overcome by Carbon Monoxide in Pittsburgh Tunnel

The twin Liberty tunnels, which form the main gateway into Pittsburgh, from five thickly populated suburbs, had to be closed recently pending an improvement in the ventilating. Scores of people were overcome while passing through the tunnel when a congestion of motor cars released more exhaust than could be carried off through the tunnel airshafts.

Bureau of Mines men, who conducted experiments just before the tunnels were opened, some months ago, had found that persons passing through were affected by carbon monoxide poisoning, but it had been thought there would be little danger so long as the motor cars were kept moving.

Correspondence

Operating Vacuum Heating Systems at Varying Radiator Temperatures

EDITOR HEATING AND VENTILATING MAGAZINE:

On page 72 of the May number of your magazine, in answer to the following question: "Also give the pressure loss in a 3-in. main, 300 ft. long, supplying 1,000 sq. ft. of cast-iron radiation, with steam at 10 lbs. absolute pressure," you state: "The conditions in the second query are questionable, as the vacuum does not extend to the inside of the radiator." In the next paragraph appears the statement that "only the returns are under vacuum."

These two statements express correctly the conditions usually found in a vacuum heating system; yet they also indicate the common disregard of what seems to me one of the most valuable features of such a system. This feature is one that, so far as I have observed, no manufacturer of vacuum heating appliances has yet used as it might be used in setting forth the advantages of his products, and it is one that apparently is entirely overlooked by designing engineers. The particular virtue of a vacuum heating system to which I refer is the possibility of operating it at different radiator temperatures to correspond with different outside temperatures, much the same as a hot water system is operated.

The radiating surface of the average steam heating system is, of course based on a heat transmission of approximately 250 B.T.U. per square foot per hour. The amount of surface installed on this basis is quite satisfactory when the outside temperature is at the minimum for which the system is designed; but when the outside temperature is above that (which is actually the case during a great proportion of the time), the radiating surface is too great, and the occupant of the room in which it is installed must either shut the valve or open a window. As a matter of fact, the window is often opened, rather than the radiator valve closed. This can be verified any winter day by observing the number of open windows in the average office building. Needless to say, a very considerable amount of fuel is lost as a result of the open windows.

It seems hardly necessary to point out the advantage of a heating system in which the engineer could vary the temperature in the radiators to balance the B.T.U. loss from the building, as it varies with changes in the outside temperature. As a matter of fact, the vacuum heating system is perfectly adapted to this method of operation, and yet the fact seems to be overlooked by manufacturers, owners, and consulting engineers alike.

Some time ago tests were made in an office building in Washington which indicated that a vacuum heating system, properly designed and properly operated, could be made to function in just this manner. The building in which the tests were made is a modern office building erected about five years ago, containing 62,000 sq. ft. of direct steam radiation, with 1,450 ½-in. radiator return traps of a standard make. Tests were made at various times which, while not complete, were an index of what could be done with such a plant. Exceptionally low pressures were carried in both the steam mains and the returns. The installation must be tight to permit this, and possibly packless radiator valves are necessary. They were used in the building under consideration. The lowest pressures reached during the test were 21 in. of mercury vacuum in the return, and 18 in. in the steam main, corresponding to about 4⅜ and 5⅞ lbs. per square inch, absolute pressure. Following are certain data, obtained during one test, which may be interesting:

Boiler pressure, 23 lbs. gauge.
Reduced pressure in steam main, 16 in. vacuum.
Temperature of low pressure steam, 233.6° F.
Pressure in return main at pumps, 21 in. vacuum.
Temperature of condensation at pumps, 124.7° F.
Pressure in radiator, 200 ft. from reducing valve, 16 in. vacuum.
Temperature in above radiator, 164° F.
Pressure in radiator 400 ft. from reducing valve, 16¾ in. vacuum.
Temperature in above radiator, 160° F.

The above figures indicated quite clearly wherein lies one of the advantages of a vacuum system, which is, as has been stated, consistently overlooked. I admit that with the usual vacuum pumps installed it would not be possible to operate the average plant in this way. However, that is a fault of design. The selection of proper pumps rests on certain basic facts which can be easily determined.

As a young engineer trying to absorb all the free information possible, I have often asked other older and wiser engineers how they arrive at the proper size of vacuum pumps, and practically without exception I find that they use some inexplicable formula whereby the number of radiator traps is divided by the number of doorknobs, or some equally useless figure; or they frankly take it out of a catalogue—which generally is wrong. I have before me a catalogue of one of the well-known manufacturers of vacuum heating specialities in which is a formula for figuring pump sizes. It starts very well, with known factors, and then suddenly introduces a mystic constant, derived from where I know not. On checking the formula it is found that a pump selected by its use would not be of the proper size to operate a vacuum system as it should be operated.

Why is it that a consulting engineer will advise a client to install a water heating system in his home because of the ease with which the radiator temperature is controlled and varied, and will then advise him to install a vacuum heating system in his business property, and fail to tell him how it also can control and vary the radiator temperature?

Why is it that we all say "the vacuum does not extend to the inside of the radiator?" Why do we not extend it to the inside?

R. C. MILLER

Washington, D. C.

A Plan to Co-Ordinate Building Maintenance with New Construction Work

Details of the plan devised by the Philadelphia Building Congress to co-ordinate maintenance and repairs with new construction work were given by D. Knickerbacker Boyd, chairman of the committee having this work in charge, in an address before the Oregon Association of Building and Construction.

As he explained it, the plan is to secure the co-operation of the owners, managers and occupants in making a survey of the maintenance and repair requirements of buildings and structures in Philadelphia and vicinity, including Federal, State and municipal works, to compile and classify such data and to make studies to determine the periods when labor on new construction work is least employed so that in every way possible maintenance work and alterations in existing structures may be done at such times as conflict least with new construction requirements and make for greater continuity of employment.

Following the address, it is announced, the Portland Association of Building Owners and Managers officially decided to defer all usual Spring and Summer maintenance and repairs as far as possible, especially indoor work, because a brief survey disclosed that much of such work frequently crowded into the summer months could be done just as easily and efficiently during slack winter periods.

The Philadelphia Building Congress is now endeavoring to interest the National Association of Building Owners and Managers in the movement, and the matter was to be brought up at the association's annual convention in Colorado Springs, beginning June 23.

New Apparatus and Appliances

The New Cochrane Integrating Flow Meter

It will be recalled that a year or so ago the Cochrane Corporation of Philadelphia, Pa., (formerly the H. S. B. W.-Cochrane Corporation) brought out a new type of flow meter for measuring water or steam in pipes. This meter was distinguished by the use of a tilting manometer, or U-tube containing mercury and balanced on a knife edge as the actuating member. The deflection of the U-tube is made proportional to the pressure differential set up at the ends of the two flexible torsion-tube connections by means of a frictionless cam pressing against a weighted metal ribbon.

The company announces that it has now added to this meter an integrating device which imposes no load or resistance to the deflection of the U-tube, so that sensitivity and accuracy are undiminished. The integrator is driven solely by the clock, the deflecting member of the meter serving only to control the position of a stop or motion-limiting pin. This has the advantage that little resistance, with its resulting inaccuracy, is placed against the motion of the deflecting member. The

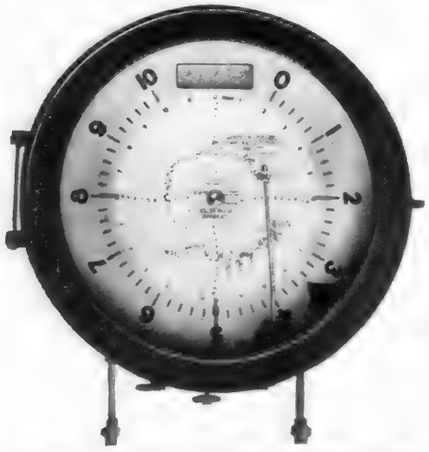


Fig. 1—Cochrane Flow Meter with Integrator

integrator goes through motions equivalent to drawing a line from zero to the pen trace on the flow-meter chart once each minute, the length of this line being proportional to the momentary rate of flow and the sum of the lines proportional to the total flow for a definite period. One stroke per minute was found to be an interval sufficiently small to give a total agreeing closely with planimeter integration.

The arrangement as described permits the use of a uniform scale on the indicator dial and the recorder chart, instead of the usual distorted scale with spacings proportionate to the square of the flow.

The instrument is calibrated by a standard weight hung on the U-tube balance. If the equalizing valve is open, the U-tube balance will come to a position marked upon a brass scale. After this has been done, the counting train of the integrator is read and the clock is allowed to run for one hour, at the end of which time the integrator should have gained 20 units. If the

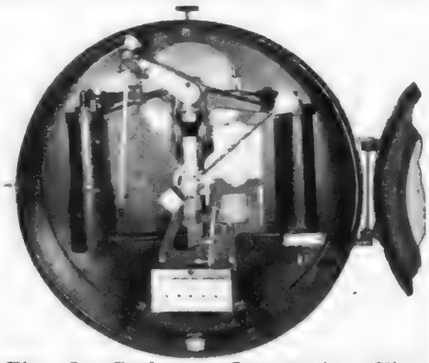


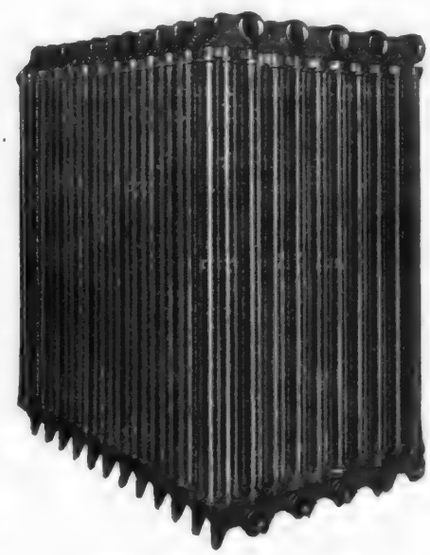
Fig. 2—Cochrane Integrating Flow Meter with dial removed, showing tilting U-tube, Clock and Integrator

reading is incorrect, the proper stop may be moved by means of an adjusting screw.

Thus adjusted, an accuracy within 1% is claimed on a run during which the flow varied from 20% to 100% of the full load rating.

Lyon Interlocking Heaters

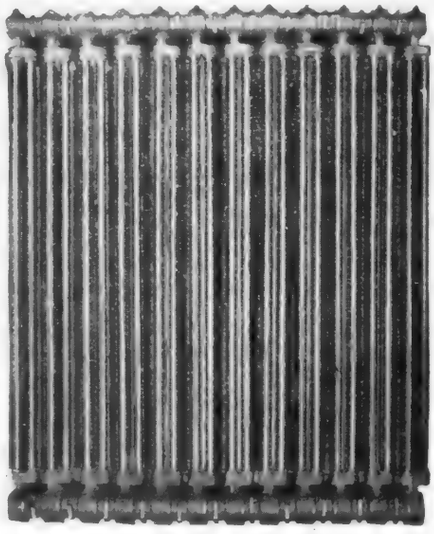
A unique form of pipe heater for indirect work, in which the headers and bases are made interlocking to allow for close assembling and the staggering of all pipes in the completed heater, has been brought out by the Lyon Products Co., Inc., 312-316 Union Park Court, Chicago, Ill. The heaters are



Lyon Interlocking Heater

built in sections consisting of a header and base of semi-steel into which eight 1-in. pipes of a given length are forced. The pipe ends are first coated with an expanding flux and then are pressed home by hydraulic pressure. In this way no threads are used. The sections are put together with extra-heavy right and left cast-iron nipples, threaded to make up the full number of threads. The manufacturers state that these heaters have been in use for several years under various pressures up to 100 lbs. without giving any trouble.

The heaters can be furnished with four different sets of nipples, to make up on either 4¼-in., 4⅝-in. or 5⅜-in. centers, so that it is only necessary to select the proper length of sections to get the amount of heating surface required without decking or piling the sections on top of each other. Also,



Arrangement of Pipe Sections in Lyon Interlocking Heater

with the use of the company's special center-feed section, it is possible to furnish heaters of any size, presenting an unbroken front from end to end.

The company states that its catalog, shortly to be issued, will contain engineering data for these units on all intake temperatures from—40° F. to 70°, F. for various steam pressures and condensation rates, and covering the four different centers.

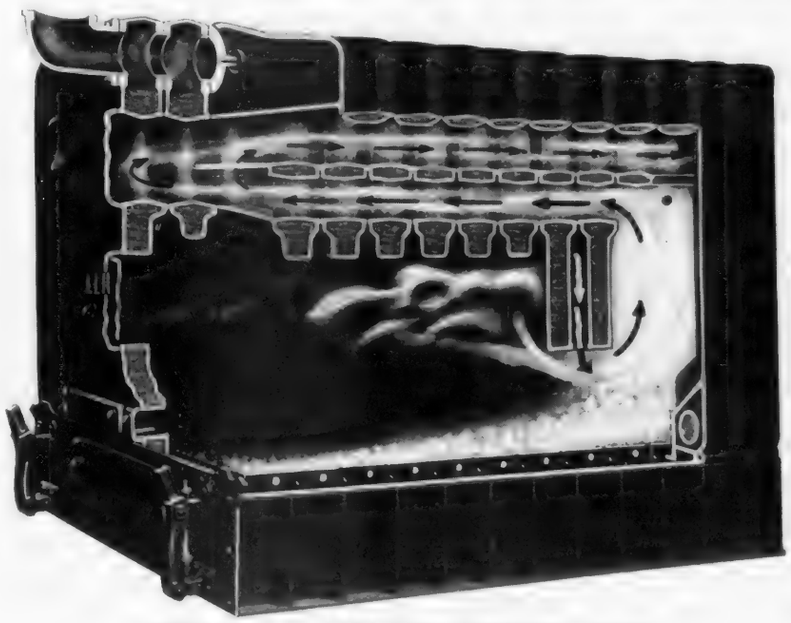
New Features of 1924 Ideal Smokeless Boiler

Several new features, developed by the company in its Institute of Thermal Research, are embodied in the 1924 Ideal smokeless boiler, recently announced by the American Radiator Company. In this boiler smokeless combustion is produced by the introduction of secondary air through the Ideal smoke "oxidizer." This oxidizer consists of a water vat air admission flue, through which fresh air is drawn from adjustable dampers on either side of the boiler.

The volatile gases distilled from the

coal are carried through a mixing channel between the bottom of the smoke oxidizer and the flue bed. Fresh air comes in contact with the gases in this mixing channel. In this oven a high temperature is obtained, permit- and their combustion. No fire-brick tile or other material of this character, it is stated, is used in any part of the boiler.

At the rear of the boiler a large gas chamber is provided to allow the ignited gases to be consumed before passing into the lower gallery of flues. Hot gases are carried through two galleries in the boiler, forward through the lower one and rearward through the upper. Machine-ground joints are made between the sections. The sections are then drawn together iron to iron as the boiler is assembled, so as to form gas-tight joints between the flues enabling the hot gases to travel the complete length of the flues.



Construction of 1924 Ideal Smokeless Boiler

The gases pass out of the boiler through a smoke box in the rear. The breeching is connected to the boiler on a smoke collar of sufficient diameter and depth to allow a tight connection between the breeching and the smoke collar. In the smoke collar there is a breeching damper operated by hand lever at the front of the boiler.

The steam connection to the boiler may be taken either from the front or rear, or both. Air is admitted to the ashpit through a lift door in the side of the boiler base. This lift door is operated by an Ideal all-metal damper regulator which is connected to the lift door by links made of iron rods, thus eliminating the chain regulator connection.

RECOMMENDED MINIMUM REQUIREMENTS FOR PLUMBING IN DWELLINGS AND SIMILAR BUILDINGS, being the final report of the Sub-Committee on Plumbing of the Plumbing Code Committee of the Department of Commerce, has been published by the Bureau of Standards as one of the Department's elimination of waste series. It is a volume of 260 pages. Copies are available from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 35 cents each.

New Books

ESTIMATING BUILDING COSTS AND APPRAISING BUILDINGS, by Frank E. Barnes, supervising building valuation engineer of the New York Central Lines, contains much to interest the heating and ventilating engineer, as it includes chapters on heating and plumbing which are filled with data useful to men in both industries. The heating data go into the cost of boilers and radiators, including freight terms, factory and warehouse shipments; cost of piping, valves, fittings, etc., labor for installing steam and water heating systems of various types, and labor required for covering and painting pipes and fittings. Correspondingly full information is given regarding plumbing work, while other chapters deal with estimating, excavation, foundations, waterproofing and damp-proofing, reinforced concrete construction, brick masonry, stone masonry, architectural terra cotta, hollow tile fireproofing, structural steel, rough and finished carpentry, furring, lath and plaster, fire doors and windows, roofing and sheet metal, marble, tile and terrazzo, painting, glass and glazing, miscellaneous iron work, hardware, elevators and dumbwaiters, electric wiring of buildings, useful data, sidewalks, curbs and gutters, appraisal of buildings and depreciation. Size 5 x 8 in. Pp. 822, including index. Published by the McGraw-Hill Book Co., Inc., New York, and may be had through the book department of THE HEATING AND VENTILATING MAGAZINE. Price, $5.00, postpaid.

New Publications

INVESTIGATION OF WARM-AIR FURNACES AND HEATING SYSTEMS, PART II, by A. C. Willard, A. P. Kratz and V. S. Day, is the title of a new bulletin (No. 141) the fourth to be published on the same general subject by the Engineering Experiment Station of the University of Illinois. It covers the work accomplished since the publication of the third report (Bulletin No. 120) in March, 1921. This investigation of warm-air furnaces and heating systems has been carried on by the Engineering Experiment Station in co-operation with the National Warm-Air Heating and Ventilating Association since October, 1918. The principal objects of the investigation, briefly, are to determine methods of increasing the efficiency and capacity of warm-air furnace heating systems, and to establish satisfactory and simple codes for testing and rating furnaces, so that the heating equipment may be properly proportioned for the work it has to do.

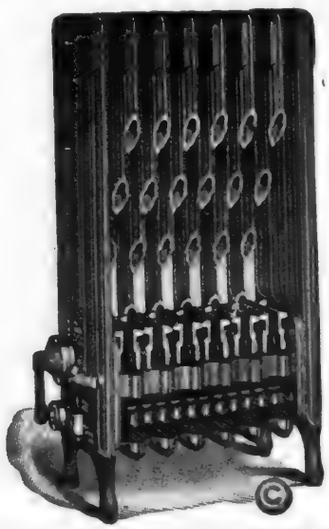
AN INVESTIGATION OF THE MAXIMUM TEMPERATURES AND PRESSURES ATTAINABLE IN THE COMBUSTION OF GASEOUS AND LIQUID FUELS, by G. A. Goodenough and G. T. Felbeck, is the title of a recent bulletin issued by the Engineering Experiment Station of the University of Illinois. Among the chemical reactions associated with high temperatures which are especially interesting to the engineer are those that occur in boiler practice, in the internal-combustion engine, in the gas producer and in the oxy-acetylene and oxy-hydrogen flame. This bulletin gives the results of a study of the phenomena in these connections and offers a method of calculating the maximum temperature resulting from the combustion of a fuel under predetermined conditions. The bulletin is listed as No. 139 and copies are obtainable without charge by addressing the Engineering Experiment Station, Urbana, Ill.

University of Illinois announces the third renewal of its short course in plumbing and heating, from September 15 to 20, 1924. This course has been prepared in co-operation with the Mechanical Equipment Association. The instruction is given for the benefit of plumbers and steam fitters of Illinois, with a view particularly towards simplification and reduction of costs. The character of the instruction, it is pointed out, will be made such that it can be understood by anyone who has the qualifications of a journeyman. Instruction will be given in the form of lectures, laboratory demonstrations and discussions. The Mechanical Equipment Association has arranged for 150 registrations. Those who wish to register should address Mr. C. D. Brownell, 109 West University Avenue, Champaign, Ill. The cost of the notes and material will be $10.00. Among the specific subjects to be taken up are

pipe friction, measurement of water and water hammer, hydraulic problems, heat transmission through building materials, steam radiators and the heat loss from various surfaces, steam heating boilers, flow of steam and condensation in heating systems, water heating systems, contractual relations, and the architect and the mechanical equipment contractor.

New Trade Publications

CLOW GASTEAM RADIATOR, designed for any type of building, old or new, and embodying the advantages of automatic control, maintaining the atmosphere at a given humidity and heating when and where desired, are presented in an attractive catalogue issued by James B. Clow & Sons, Chicago, Ill. Any desired number of radiators may be used, as each radiator is a complete, independent heating unit. The conventional cast-iron radiator form of construction is used. The

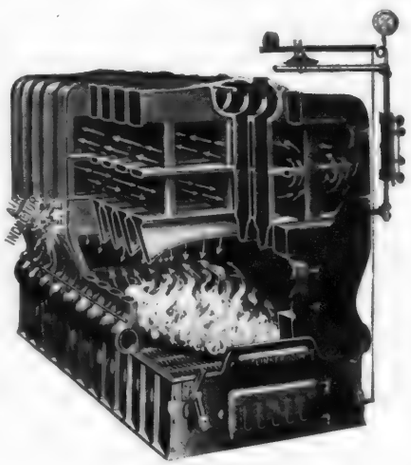


Sectional View of Clow Gasteam Radiator Showing Burner and Combustion Chamber

water chamber is in the lower part of the radiator. Directly underneath is a Bunsen burner. Each radiator is equipped with an automatic air valve and an automatic regulator, to control the fuel consumption. A body of water 1 in. deep is maintained in the radiator. When the burner is lighted, 5 lbs. steam pressure it is stated, is raised in about 30 min. This steam pressure is used to automatically reduce and regulate the gas flow. Means for replenishing the water are provided by removing the filling cup cap and filling to the desired level. The manufacturers state that this should be done at intervals of two weeks. To light the radiator a lighted match is applied to the burner and the gas cock turned on. Two types are manufactured by the company, the Doric type, made in two heights, 26 in. and 38 in., and the Colonial type, made in three heights, 22 in., 26 in. and 38 in. Size 6 x 9 in. Pp. 16.

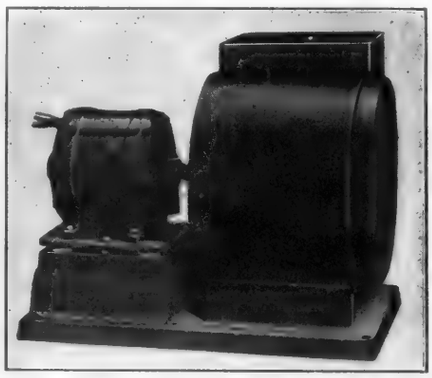
SMITHOGRAMS, a monthly periodical edited in the interests of better welding for free distribution, is being published by Smith's Inventions, Inc., 2619-2633 Fourth Street, S. E., Minneapolis, Minn., manufacturers of welding and cutting equipment. A typical issue contains some useful data on cast-iron welding, while another issue discusses at length sheet-metal welding.

MONARCH UP-DRAFT SMOKELESS BOILERS and their adaptability for burning soft coal, hard coal or coke, are the subject of a timely circular issued by the Wm. H. Page Boiler Co., 58 West 40th Street, New York. As the catalogue states, there is an increasing demand for a heating boiler that will burn soft coal without smoke. This demand has been brought about by the increased use of soft coal, due to the high cost or inadequate supply of anthracite coal. The fact that the Monarch up-draft smokeless boiler is of the single-grate type, places it in line with the latest developments in the smokeless boiler field. The products of combustion rise in the firebox, coming in contact with the direct overhanging fire surface, passing thence to the rear or secondary combustion chamber. At that point air from both sides of the boiler is admitted through an air inductor over the fuel bed, this inductor being designed to admit a mixture of the proper proportions for satisfactory combustion. The ignited gases turn and pass through the lower tier of flues to the front of the boiler and back to the chimney through the upper tier. While this boiler is designed primarily for soft coal, the manufacturers point out that it is also adapted for burning hard coal, coke, wood, oil or gas. Full rates and dimensions are included for both the steam and water series. Size 8½ x 11 in. Pp. 4.



Monarch Up-Draft Smokeless Boiler

BULLETIN OF EXHAUST VENTILATION, issued by the Herman Nelson Corporation, Moline, Ill., as a supplement to its Univent catalogue, is devoted to the company's line of Silentvents, especially constructed for exhaust ventilation in schools and similar buildings. Their quiet operation, it is stated makes them particularly suitable for chemical laboratories, kitchens, toilets, smoking rooms or any place where obnoxious gases or odors are to be removed. Silentvents, it is announced, are regularly fitted with a screen over the in-



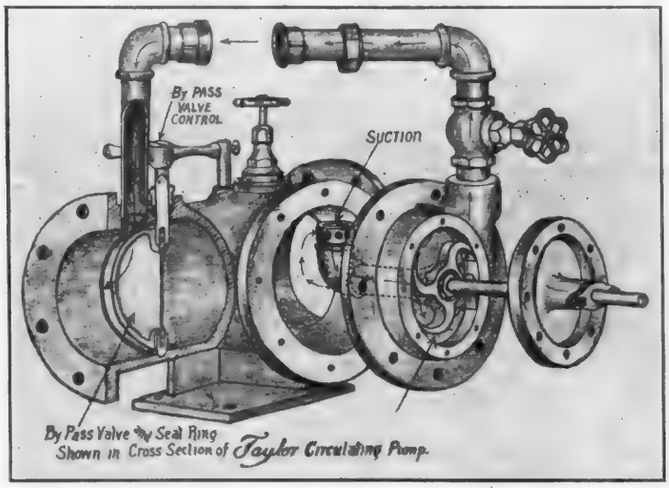
Silentvent Exhaust Fan

takes so that they may draw directly from the space in which they are located, but this screen can be removed and a sheet-metal exhaust pipe connected to the intake. The company recommends that each unit be provided with a sheet-metal discharge pipe connected into the vertical flue or extended out of doors through a window or opening in the wall, also that flexible canvas connections be used in all connections to ducts. Data are included for determining the proper size of discharge pipe and the proper size of exhaust piping. The units are furnished with either 125-volt direct current, or with single-phase 60-cycle 110-volt alternating current motors, as desired. An allowance of 1.6 amperes for direct current and 150 watts for alternating current is suggested as safe for all sizes for determining wiring, etc.

BARBER JET-TYPE GAS BURNERS, which were for over four years in process of development and which are based primarily upon the original Barber patents, are featured in special circular matter received from the Cleveland Gas Burner & Appliance Co., 3702-3704 Superior Avenue, Cleveland, O. This company has just closed its fiscal year and reports the past year as one of the best of the six the company has been in business. Many new designs of the Barber blast-flame patented gas burners have been added to the company's line, principally for furnaces, and steam and water boilers, while the jet-type burners, already referred to, have been found particularly adaptable to water heaters, small steam generators, coffee urns and similar appliances. The jets, which hood or envelope the flow of gas as

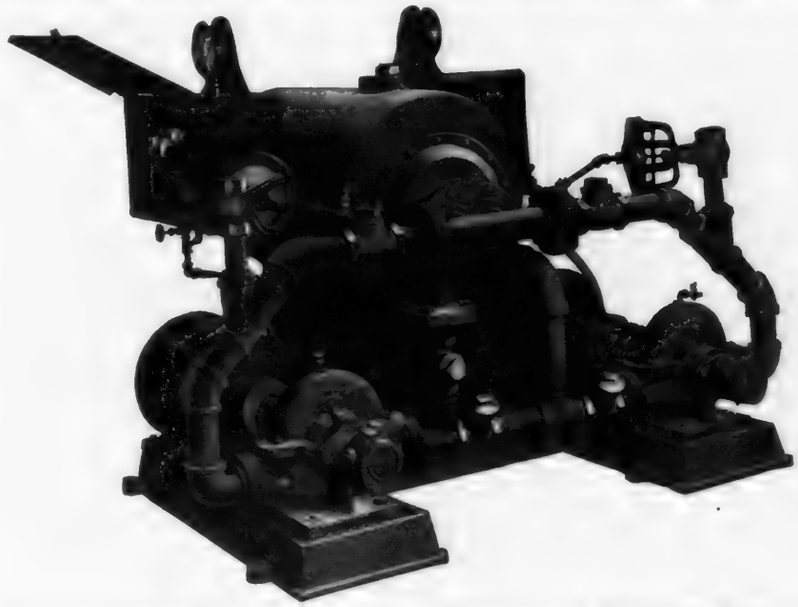
it leaves the small orifices, are provided with auxiliary air openings of specific size to equalize the additional air in conformity with the gas capacity of the orifices, at a point directly across the top of the orifice openings. This provides means for a thorough mixing of the auxiliary air with the gas before the mixture leaves the jets, thereby creating a much shorter body of flame, which is preferred in many appliances. Additional air is then mixed with the mixture after leaving the jets or tubes, which causes the flame to be similar in volume at the burning points as with the regular line of Barber burners. Jet burners, it is stated, produce an even, orange-blue flame on high, medium, low or fluctuating gas pressures. The high velocity of the gas serves to prevent the jets or orifices from being clogged. The "S"-Type jet burner, it is stated, may be turned down with safety to consume 1 cu. ft. of gas per hour, and the "Z"-Tube burner, so that it will consume 1½ cu. ft. per hour. No mechanical air mixers are used for the various pressures and no pilot lights are required.

TAYLOR CENTRIFUGAL CIRCULATING PUMPS, a new product of the Taylor Machine Works, Battle Creek, Mich, for which patents have been asked, is described in that company's Bulletin No. 22. The manufacturers state that the pump can be used either in the flow or the return-line of any water heating system. The pressure from the pump discharge is designed to increase the flow of water and when the by-pass valve is closed all the water flows in one direction. Each pump is equipped with a suction and discharge valve. By closing these valves it is possible to repack the stuffing box, or to take out the impeller and shaft, without drawing the water from the system. The pump is made for either right or left-hand discharge. The bulletin, in addition to a description of the product and several illustrations, contains a price list and data on pumps of varying sizes.



Taylor Centrifugal Pump, Showing By-Pass Valve and Seal Ring

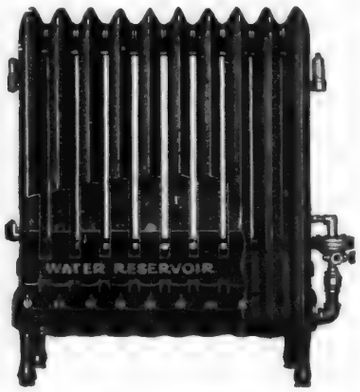
ECONOMY CENTRIFUGAL VACUUM-BOILER-FEED PUMPS, showing standard single units, standard duplex units, and special duplex units, comprising the line of the Economy Pumping Machinery Co., Chicago, Ill., are brought to the attention of the trade in a new bulletin illustrating each unit and including the required data. All Economy vacuum pumps, it is stated, having capacities over 5000 sq. ft. are equipped with double-suction horizontal split case pumps, which are characterized by the company as an exclusive feature. The company's single unit is recommended for use where a high-grade vacuum pump is required, but where the expenditure must be kept within fixed limits. The duplex units are recommended wherever the cost of installation requires less serious consideration. The standard duplex is arranged with a single tank mounted between two centrifugal pumps and motors. Each pump and motor is equipped with its individual vacuum control. In the special duplex, both pumps are located on the same side of the tank, this arrangement being designed for installations in corners, under stair-ways or in similar locations. The usual form of drive is the electric motor, but, it is stated, steam turbines may be readily applied to the Economy design. The bulletin lists the advantages of this line and concludes with suggestive specifications, details of design and construction, dimensions and operating data, followed by numerous views of buildings Economy-equipped. Size 8½ x 11 in. Pp. 12.



Standard Duplex Economy Centrifugal Vacuum and Boiler-Feed Pump

BUFFALO UNIT HEATERS, with various types of heating surface, including Vento, pipe coils and Aerofin coils, are presented in a new catalogue (No. 465) issued by the Buffalo Forge Co., Buffalo, N. Y. The catalogue first analyzes the situation in the unit heater field and refers to the usefulness of these units in supplementing the heating systems of factories, garages or storage sheds, as well as for use in new buildings where floor space is at a premium. The efficiency of the heating surface is given at from four to five times that of direct radiation. Finally, it is stated, most all classes of buildings have cold corners in extreme weather where it is difficult for the men to put forth their best efforts. In such locations unit heaters have been found especially serviceable. The illustrations contained in the catalogue show the heaters installed above the floor level. Where steam is not available, the company has developed a direct-fired heater in the form of a warm-air furnace, with means for blowing air out at the top of the furnace at a moderate velocity, usually in four different directions, while the cold air is taken off the floor line and blown through the furnace. Size 8½ x 11 in. Pp. 8.

BUFFALO GAS-FUEL STEAM RADIATORS, described as offering heating comfort without coal, dirt or ashes, are presented in an envelope-size circular of eight pages recently issued by the Buffalo Gas Radiator Corporation, North Tonawanda, N. Y. The circular is listed as No. 21. Buffalo radiators, made of cast-iron, are individual heating units, furnishing steam heat. Each



Buffalo Gas-Fuel Steam Radiator

radiator is equipped so that a part of the radiator may be turned off during mild weather.

IT DOES THE TRICK WITH FIRE BRICK is the interesting caption on an announcement of the new fire-brick ring series of water heaters manufactured by the Weil-McLain Co., Chicago and Michigan City, Ind. As will be seen from the accompanying illustration, the lower portion of this water heater is surrounded by fire-brick. This arrangement is made so that the brick will become heated quickly and keep the fire burning brightly at the outer edge,

Fire-Brick Ring in New Weil-McLain Water Heater

as well as at the center. This acts to complete the burning of the fuel, making it possible to furnish a plentiful supply of hot water at a low cost per gallon of water heated.

The purpose of the new fire-brick ring design is to overcome the troubles caused where the lower portion of the firepot is surrounded by chilling water. This cold water ordinarily would produce an outer circle of dead fire, resulting very often in the fire's going out, leaving a waste of unburned fuel in the firepot, a scanty supply of hot water and high cost per gallon of water heated.

It is claimed for the new Weil-McLain Scientific Combustion water heater that, when connected to a hot-water storage tank, it will give a continuous supply of hot water for all purposes at a minimum cost and with little attention and easy operation. Triangular type grates are used which are designed to cut and shake out all ordinary clinkers and to make it easy for the operator to keep the fire clean.

Death of Horace M. Swetland

The career of a dominent personality in the trade and technical publishing field was brought to a close when Horace M. Swetland, president of the United Publishers' Corporation and its subsidary, the Class Journal Company, died June 15 at his home in Upper Montclair, N. J. Mr. Swetland had been ill with pneumonia for two weeks preceding his death, although he had not been well since last November. He was 71 years old.

Mr. Swetland was one of the men pioneers in the business-paper publishing field who was always in the forefront of every important movement which marked the turning points in the development of modern trade journalism. He early became associated with Emerson P. Harris and was joined, in 1885, by John J. McGraw, now president of the McGraw-Hill Co., Inc., of New York.

Mr. Swetland was one of those early who established *Power*, in 1884. Four years later he became the sole owner of that journal which he published during the ensuing twelve years.

When the automobile industry began to assume large proportions, Mr. Swetland purchased and merged several automobile publications and later organized the Class Journal Company, for the purpose of publishing industrial papers in the automobile industry. This company and its publications were merged with the United Publishers Corporation in 1911. Mr. Swetland became president of the latter company in 1912, remaining in that position up to the time of his death.

His most recent contribution to the business-paper field was the editing of the course of instruction in trade and technical journalism compiled by the Associated Business Papers and published in bound form under the title of "Industrial Publishing."

Mr. Swetland leaves a widow, three daughters and one son. He also leaves a brother, A. B. Swetland, who has been his life-long associate in business, having acted for 37 years as manager of the Swetland publishing interests.

HENRY LIPKEMAN, president of the Advance Boiler Corporation, New York, died June 14, after a long illness. He was 50 years old. Mr. Lipkeman was the principle organizer of the Advance Boiler Corporation, in 1922, which has already made a place of importance for itself in the boiler manufacturing field. He had long been active in the heating industry, having been sales manager for many years of the Peerless Heater Co., of Pittsburg, Pa.

Death of Burton P. Hall

Burton P. Hall, general manager of the Mechanical Equipment Co., New York, which he organized in 1908, and a well-known consulting engineer in the steam heating and power field, died at his home in Fanwood, N. J., June 24, after an illness of several weeks. He was in his 58th year.

Mr. Hall had a wide acquaintance in the building industry, as well as among heating engineers and contractors, and was known as an expert in his line whose judgment and integrity won for him a unique clientele. He was a graduate of Stevens Institute, class of '88, being the valedictorian of his class. He was a member of Theta Xi fraternity and Tau Beta Pi Society.

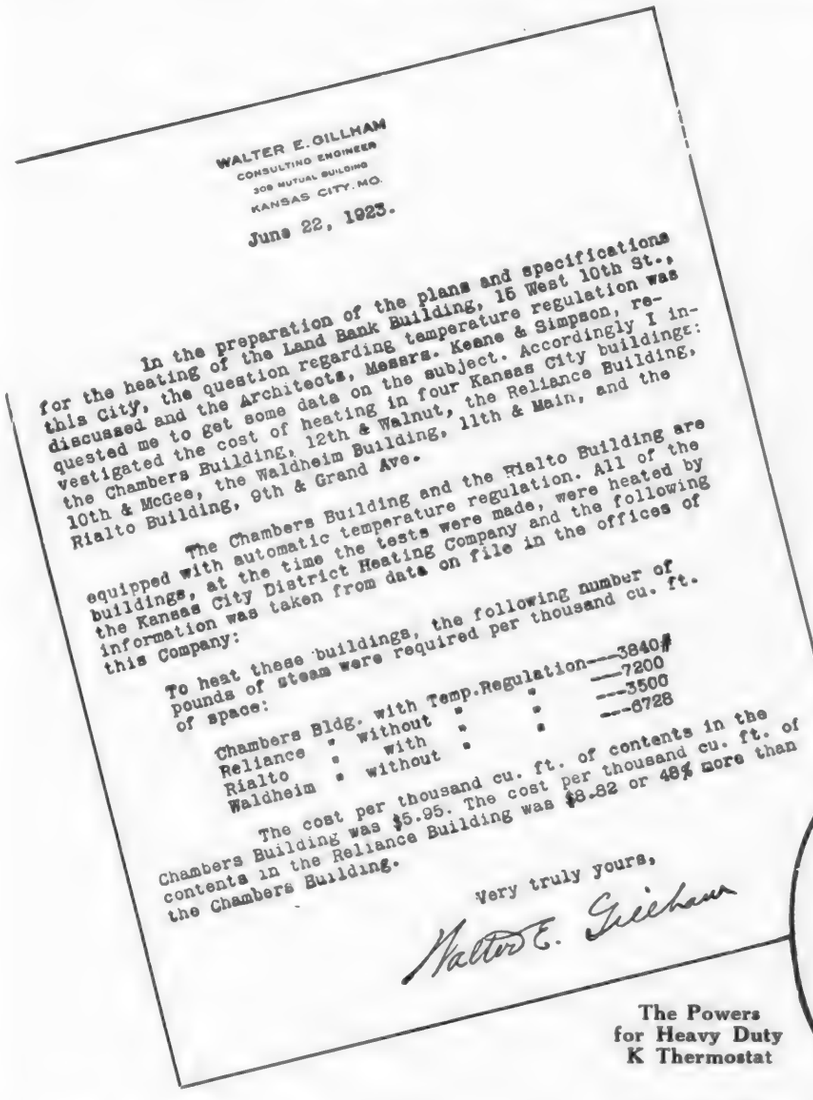
Prior to 1910, he supervised, as engineering contractor, such major operations as the mechanical equipment of the New York Custom House, the R. H. Macy Department Store, in New York, and the Naval Academy, at Annapolis. In addition to his other activities he was, for many years, consulting engineer for Trinity Corporation, New York. He was also active in civic affairs, having served as Mayor of Fanwood for two terms and also as a member of the Union County Board of Freeholders.

Mr. Hall's inventive accomplishments were evidenced in patents covering fire protection devices, mechanical photographic processes and other mechanical aids to the industrial arts. He was a member of the American Society of Mechanical Engineers.

He is survived by his widow and one son, Clifford A. Hall, and four brothers. Colonel Henry L. Hall, of Plainfield, N. J.; Robert E. Hall, of Chicago; George E. Hall, of Holyoke, Mass., and Harold M. Hall, of Trenton, N. J.

S. OLIN JOHNSON, president and one of the founders of the Penberthy Injector Co., Detroit, Mich., died recently in a sanitarium in Los Angeles, Calif. He was 77 years old.

Mr. Johnson was instrumental in 1902 in effecting an amalgamation of the Brass Manufacturers' Association and the Metal Manufacturers' Association under the name of the Detroit Employers' Association.



WALTER E. GILLHAM
CONSULTING ENGINEER
308 MUTUAL BUILDING
KANSAS CITY, MO.

June 22, 1923.

In the preparation of the plans and specifications for the heating of the Land Bank Building, 16 West 10th St., this City, the question regarding temperature regulation was discussed and the Architects, Messrs. Keene & Simpson, requested me to get some data on the subject. Accordingly I investigated the cost of heating in four Kansas City buildings: the Chambers Building, 12th & Walnut, the Reliance Building, 10th & McGee, the Waldheim Building, 11th & Main, and the Rialto Building, 9th & Grand Ave.

The Chambers Building and the Rialto Building are equipped with automatic temperature regulation. All of the buildings, at the time the tests were made, were heated by the Kansas City District Heating Company and the following information was taken from data on file in the offices of this Company:

To heat these buildings, the following number of pounds of steam were required per thousand cu. ft. of space:

Chambers Bldg. with Temp.Regulation---3840#
Reliance " without " " ---7200
Rialto " with " " ---3500
Waldheim " without " " ---6728

The cost per thousand cu. ft. of contents in the Chambers Building was $5.95. The cost per thousand cu. ft. of contents in the Reliance Building was $8.82 or 48% more than the Chambers Building.

Very truly yours,

Walter E. Gillham

The Powers for Heavy Duty K Thermostat

This Test Shows

48 per cent Saving of Steam with POWERS temperature control

Does automatic temperature control in Workrooms, Offices, Schools, etc., really pay?

The proof shown in the above test is typical of many others which have shown remarkable savings of fuel with automatic temperature control.

Tests show that the majority of workrooms are overheated. Eliminate overheating with Powers temperature control, and you improve the health and increase the output of workers. The effect overheating has on the output of men is shown in the report of the New York State Commission on Ventilation, which says:

"An increase of room temperature from 68° F. to 75° F. caused a decrease of 15 per cent in the physical work performed by men who were not compelled to maximum effort but were stimulated by a cash bonus."

Send for Interesting Book

Our book, "THE ELIMINATION OF HEAT WASTE," shows how and why a Powers System of Temperature Control gives such remarkably long and accurate service, and why its high first cost is cheapest in the end. May we send you a copy?

Partial List of Users

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Crane Co.
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Wm. Wrigley, Jr. Co.
DuPont Fabrikoid Plant
Hartford Fire Ins. Co.
Willys-Overland Co.
Julius Kayser Co.
New England Tel. & Tel. Co.
Walter Baker & Co.
Phoenix Mutual Life Ins. Co.
Rothacker Film Co.
B. & O. Railway
Yellow Cab Mfg. Co.
Irving Pitt Mfg. Co.
Fleischmann Co.
Federal Reserve Bank, Kansas City, Mo.
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Consolidated Gas Co., New York City
Chicago Telephone Co.
Yale University
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Over 30 years of specialization in automatic temperature control

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Charlotte, N. C.	Detroit	Los Angeles	New York	St. Louis		

2450 A

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

VAPOR HEATING

Hoffman Controlled Heat

(*Continued from Data Sheet No. 132-XX*)

Supply Mains.—Table 1 is computed for pressure loss of 2 oz. at the farthest radiator for length of main, allowing for average amount of elbows, tees, etc., and condensation in covered piping—steam and condensation flowing in same direction.

To size a main, measure length of piping from boiler to farthest radiator and use proper column for this length for sizing entire length. Example: Measured length from boiler to farthest radiator 295 ft.—use Column F.

Load at end of main	280 sq. ft.	=2½-in. main
Load 50 ft. from end of main	450 sq. ft.	
Total load to this point	730 sq. ft.	=3½-in. main
Load near boiler	400 sq. ft.	
Total load to boiler	1130 sq. ft.	=4-in. main

TABLE 1—CAPACITY OF SUPPLY MAINS IN SQUARE FEET DIRECT RADIATION

	Measured Length of Pipe in Feet from Boiler to Farthest Radiation					
Col. A Size of pipe, In.	Col. B 100	Col. C 150	Col. D 200	Col. E 250	Col. F 300	Col. G. 400
2	325	260				
2½	550	450	390	347	310	275
3	1000	810	710	632	578	500
3½	1500	1215	1065	948	860	750
4	2100	1700	1500	1325	1200	1050
4½	2900	2350	2060	1830	1670	1450
5	3700	3000	2600	2340	2140	1850
6	5700	4600	4047	3600	3300	2850
7	8000	6480	5680	5050	4600	4000
8	11000	8900	7810	6950	6350	5500
10	20000	16200	14200	12600	11500	10000
12	30000	24300	21300	18960	17300	15000

For steam and condensation flowing in opposite directions, use pipe one size larger than given in table.

TABLE 2—CAPACITY OF WET RETURN MAINS IN SQUARE FEET

Size of pipe, In. Diam.	1¼	1½	2	2½	3	3½
Length 100 ft.	1500	3000	6000	10000	18000	26000
Length 200 ft.	1200	2500	5000	8000	14000	20000
Length 300 ft.	1000	2000	4000	6000	11000	16000

TABLE 3—CAPACITY OF DRY RETURN MAINS IN SQUARE FEET

Size of pipe, In. Diam.	Length in Feet from Bottom of Riser to Differential Loop.					
Col. A	Col. B 100	Col. C 150	Col. D 200	Col. E 250	Col. F 300	Col. G. 400
1	320	300	288	272	245	210
1¼	670	630	600	570	535	470
1½	1300	1215	1170	1100	1045	910
2	2300	2185	2070	1955	1840	1610
2½	3800	3610	3420	3200	3040	2660
3	7000	6650	6300	5950	5600	4990
3½	10000	9500	9000	8500	8000	7000
4	15000	14250	13500	12750	12000	10500

Where possible dry return mains are to start high at differential loop and grade down to low point and drip into wet-return main.

Starting at the loop, pipe sizes to be as follows:

Installations up to 1000 sq. ft.	1 in.
From 1001 to 3500 sq. ft.	1¼ in.
From 3501 to 7500 sq. ft.	1½ in.
From 7501 to 15,000 sq. ft.	2 in.

(*Continued on Data Sheet No. 132-ZZ*)

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THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

VAPOR HEATING

Hoffman Controlled Heat

(Concluded from Data Sheet No. 132-YY)

Example: Length of main, 190 ft. Total radiation, 2050 sq. ft. Then use Column D for sizing.

Start at loop with		1¼ in.
Up to 90 ft. from loop	560 sq. ft.	= 1¼ in.
From 90 ft. to 140 ft. from loop	560 sq. ft.	
Total load to this point	1120 sq. ft.	= 1½ in.
From 140 ft. from loop to end	1000 sq. ft.	
Total load on main	2120 sq. ft.	= 2 in.

TABLE 4—CAPACITIES OF SUPPLY RISERS IN SQUARE FEET

Length in Feet from Boiler to End of Riser.

Size of pipe, In. Diam. Col. A	Col. B 100	Col. C 150	Col. D 200	Col. E 250	Col. F 300	Col. G 400
1	40	32	28	25	23	20
1¼	75	60	53	47	43	37
1½	150	120	105	95	86	75
2	300	240	210	190	173	150
2½	500	400	355	315	285	250
3	900	730	630	565	520	450

Horizontal branches to risers to be one size larger than riser.

TABLE 5—CAPACITIES OF RETURN RISERS IN SQUARE FEET

Size of Pipe, In. Diam.	¾	1	1¼	1½
Capacity in Square Feet	300	630	1300	2200

TABLE 6—RADIATOR CONNECTIONS

Supply			Return		
Valve Number	Vertical inlet pipe to valve In. Diam.	Horizontal Runout from Vertical Inlet Pipe to Riser or Main	Valve Number	Stub to valve In Diam.	Horizontal Runout to Riser or Main In. Diam.
7	¾	Up to 5 ft. long 24 sq. ft. = 1 in. 70 sq. ft. = 1¼ in. 150 sq. ft. = 1½ in. 200 sq. ft. = 2 in. Over 5 ft. long 16 sq. ft. = 1 in. 60 sq. ft. = 1¼ in. 130 sq. ft. = 1½ in. 175 sq. ft. = 2 in.	8	½	¾

Radiators to be water-type of not over 200 sq. ft. capacity, tapped or bushed at the top for No. 7 Hoffman adjustable modulating valve and at the bottom ½ in. eccentric turned down for No. 8 Hoffman return valve.

Supply and return connections can be made at same or opposite ends, as desired. All radiators to be washed clean of core sand before making valve connections.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

VAPOR HEATING

Webster Type R Modulation System

The layout of a typical Webster modulation system is illustrated in Fig. 1. A modulation or graduated control valve is attached to the inlet of each radiator and a thermostatic trap to the outlet. The water and air pass out of the radiators through the thermostatic traps and flow back by gravity in the overhead dry return piping to a vent trap and a boiler return trap. The vent trap permits the air to pass out of the system, but prevents any water following. The return trap automatically delivers water to the boiler, regardless of the steam pressure therein, provided it is less than 15 lbs. Besides serving as a venting device, the vent trap acts as a storage tank to contain the

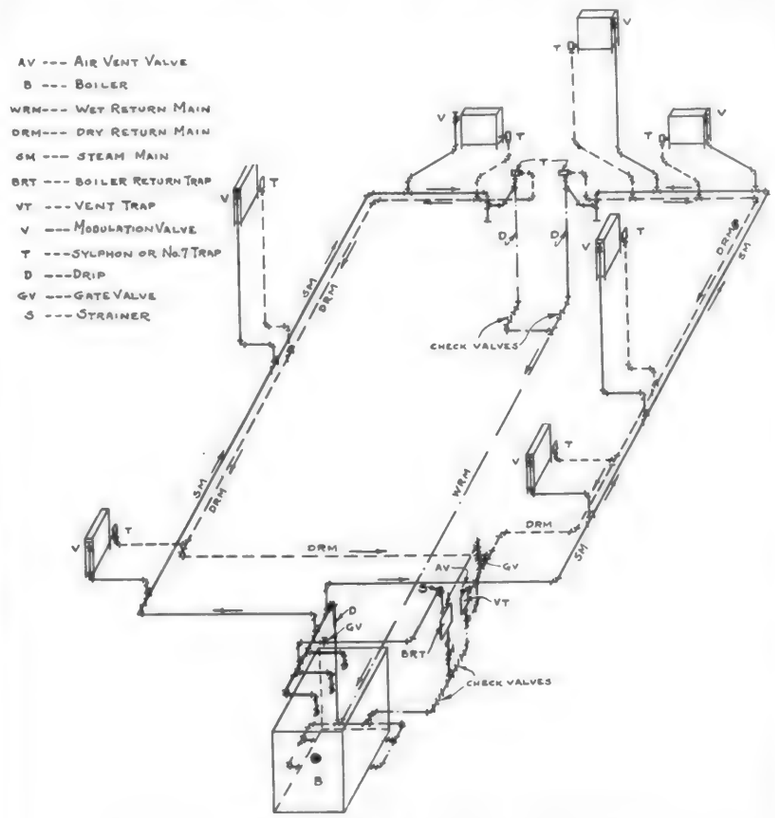

FIG. 1—WEBSTER TYPE R MODULATION SYSTEM

water flowing back from the system, while the boiler return trap is discharging to the boiler, thereby preventing its accumulation in the dry return. Attached to the air outlet of the vent trap is a vent valve which allows the air to escape, but closes to prevent its return, thus holding any vacuum formed in the system.

The piping around the vent trap and boiler return trap is arranged as indicated in Fig. 2. The condensation enters and leaves the return trap through the opening in the bottom. Steam is led from the boiler to the steam inlet valve of the trap and the exhaust outlet is connected into the dry return. With the float of the boiler return trap in its lowest position, the steam valve is closed, the exhaust valve is open. Condensation flows from the horizontal dry return into the vent trap and thence into the main return piping.

(Continued on Data Sheet No. 132-J (revised)

VAPOR HEATING—THE WEBSTER SYSTEM | No. 132-I Revised

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THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

VAPOR HEATING

Webster Type R Modulation System

(*Continued from Data Sheet No. 132-I (revised)*)

During the time that the boiler pressure is very low, the static head required to overcome this pressure is small and the water will return directly to the boiler without the assistance of the boiler return trap. As soon as the pressure rises, the water rises in the return trap. When it reaches the high level point, the float lifts, quickly closing the exhaust valve and opening the steam valve. Steam, at boiler pressure, is admitted to the space above the water. The pressure rapidly equalizes with that in the boiler and, owing to the greater height of water in the trap, it flows into the boiler. When the level of water falls to the low point, the float

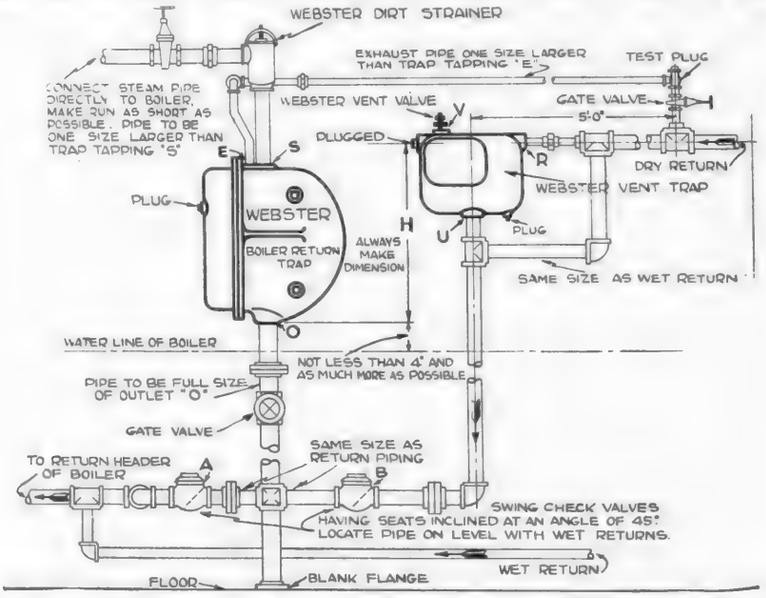
WEBSTER DIRT STRAINER
EXHAUST PIPE ONE SIZE LARGER THAN TRAP TAPPING "E"
TEST PLUG
CONNECT STEAM PIPE DIRECTLY TO BOILER. MAKE RUN AS SHORT AS POSSIBLE. PIPE TO BE ONE SIZE LARGER THAN TRAP TAPPING "S"
WEBSTER VENT VALVE
GATE VALVE
5'-0"
PLUGGED
DRY RETURN
WEBSTER VENT TRAP
PLUG
WEBSTER
BOILER RETURN TRAP
ALWAYS MAKE DIMENSION
PLUG
SAME SIZE AS WET RETURN
WATER LINE OF BOILER
NOT LESS THAN 4" AND AS MUCH MORE AS POSSIBLE
PIPE TO BE FULL SIZE OF OUTLET "O"
GATE VALVE
SAME SIZE AS RETURN PIPING
TO RETURN HEADER OF BOILER
SWING CHECK VALVES HAVING SEATS INCLINED AT AN ANGLE OF 45°. LOCATE PIPE ON LEVEL WITH WET RETURNS.
FLOOR
BLANK FLANGE
WET RETURN

FIG. 2—ARRANGEMENT OF PIPING AROUND BOILER TRAP AND VENT TRAP

drops, closing the steam valve, opening the exhaust valve and allowing the steam to pass into the return pipe where it is immediately cooled. As soon as equalization takes place between the interior of the boiler return trap and the dry return, condensation immediately commences to enter the trap again and the cycle repeats itself. The two check valves in the piping serve, respectively, to prevent the water passing into the return while the trap is discharging to the boiler, and from leaving the boiler while the return trap is in the act of filling.

After sufficient pressure has been raised in the boiler to completely fill the radiators with steam and expel the air, it may be operated for a period under vapor or even partial vacuum. Any vacuum formed in the radiators by the condensation of the steam, and communicated to the return is held by the vent valve. Eventually this vacuum of condensation finds its way through the supply piping to the boiler. When this condition is reached, the heated water within the boiler continues to give off vapor even when its temperature is below 212°, the boiling point at atmospheric pressure.

While the quantity of vapor thus produced may not completely heat every radiator or proportionately heat each radiator, at the same time it may be sufficient for comfort in mild weather or during the night.

The modulation supply valve is constructed as shown in the cross section, Fig. 3. It is of the quick opening, non-rising stem type and built for quick opening or closing with less than a complete turn of the handle. The modulation effect is produced by a tapered plug, which varies admission of steam in progressive volumes with the lift of the valvepiece.

The piping system is designed to secure circulation of the steam at a very small drop in pressure, usually not over 2 to 4 oz. Thermostatic traps are attached to the ends of the steam mains to vent the air into the dry returns. The mains are also dripped into a wet-return which is run back separately to the boiler.

(*Continued on Data Sheet No. 132-J1*)

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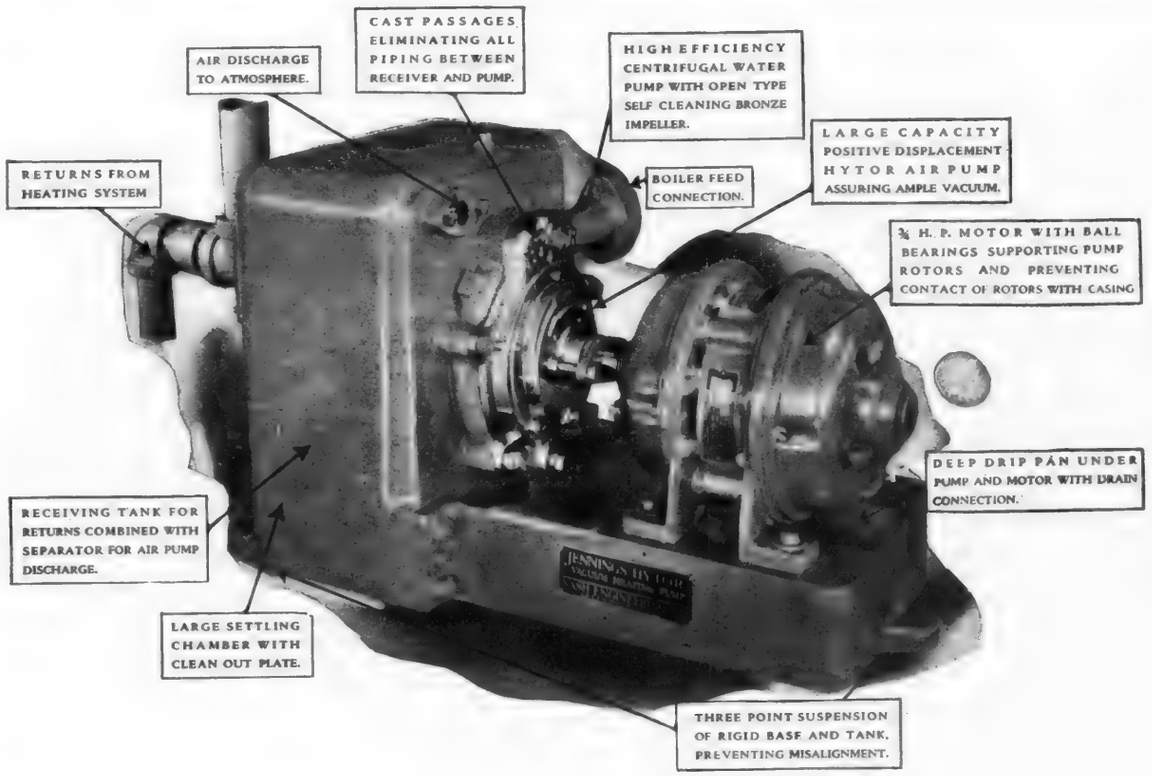
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RETURNS FROM HEATING SYSTEM
BOILER FEED CONNECTION.
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¾ H. P. MOTOR WITH BALL BEARINGS SUPPORTING PUMP ROTORS AND PREVENTING CONTACT OF ROTORS WITH CASING
DEEP DRIP PAN UNDER PUMP AND MOTOR WITH DRAIN CONNECTION.
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July 1924

Trade and Miscellaneous Notes

Miscellaneous Notes

Building Construction in May declined 3% over the previous month and about 13% over the same month a year ago, according to the F. W. Dodge Corporation, which fixed the May, 1924, building contracts at $419,272,600, this figure covering reports in 36 eastern States comprising seven eighths of the country's total construction activity. Substantial increases in building were reported from New England, the northwest and the southeast but elsewhere activity decreased. Total construction started between Jan. 1, 1924 and June 1, 1924 totaled $1,934,240,800, an unprecedented figure, 11% above the corresponding period in 1923.

Chicago Association of Oil Burner Manufacturers and Accessory Men gave a dinner recently to promote good fellowship and to exchange ideas on the oil burning industry. The dinner was along lines similar to those which held at the dinner of the Chicago Oil Burner Men's association in Chicago some time ago.

American Association of Oil Burner Manufacturers announces the appointment of Homer R. Linn of the American Radiator Co., as chairman of the committee on co-operation with boiler and furnace manufacturers.

Eastern Supply Association met recently at the Hotel Astor, New York, when an exceptionally interesting program was offered the manufacturers and jobbers present. H. R. Conley of the Division of Simplified Practice, Department of Commerce, was one of the chief speakers.

Pittsburgh, Pa.—Low-pressure cast-iron boiler manufacturers met recently at the research laboratory of the American Society of Heating and Ventilating Engineers in Pittsburgh to consider the matter of boiler ratings. A committee was appointed to go further into the best methods of testing and rating low-pressure boilers and to report back at a meeting to be held later.

National Exhibition of Architecture and Allied Arts is announced for April 30 to May 2, 1925 in the Grand Central Palace, New York, under the auspices of the American Institute of Architects and the Architectural League of New York. The building trades will be given a prominent place in the exhibition and displays are planned for various heating and ventilating systems under home and factory conditions.

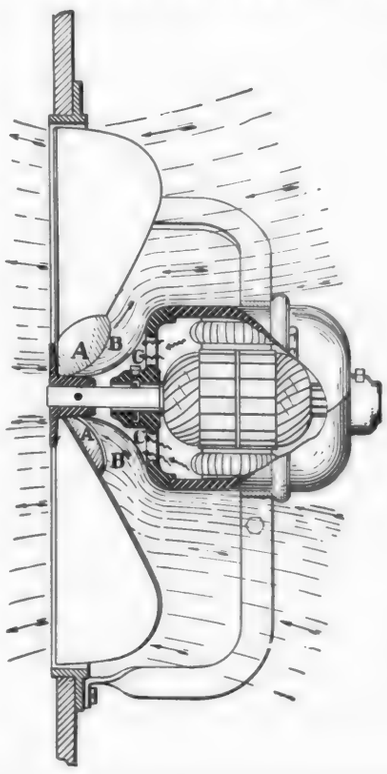
Milwaukee, Wis.—Plans for the Third Graphic Arts Exposition and the International Association of Printing House Craftsmen, to be held in Milwaukee August 18 to 23, 1924, are well developed. The exposition is intended to show at close range specimens of high-grade printing of every description.

National Industrial Conference Board reports that while there was no significant change in earnings in April, employment declined 2.5% from the preceding month and the average hours fell off nearly half an hour a week. Of about 1,700 plants included in the survey, ten reported a shut-down in April and 150 others worked less than normal hours.

Kansas City, Mo.—The new Clark Estate Office and Medical Arts building being erected in Kansas City, Mo., will be 12 stories and basement in height. It is to be of steel and reinforced concrete construction throughout.

Minneapolis Heat Regulator Co., Minneapolis, Minn., announces that it has taken over the entire business of C. O. Baring, Inc., its New York distributor. The business is to be conducted as a factory branch in the same location in the Grand Central Terminal Office building and at 34 Park Place, Newark, N. J. W. H. Wilson, who has been elected a vice-president, will have charge of the branch.

AUTOVENT FANS ARE RADIATION COOLED



Autovent Fans do not rely on a continuous passage of air through the motor to cool it. As a result, there is no possibility of contamination to Autovent Fan motors, due to grease, smoke or dust laden air.

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National Trade Extension Bureau of the Plumbing and Heating Industries announces that its accounting service department, directed by G. H. Wilson, has met with great success in establishing classes in T. E. B. accounting. Text books and all necessary supplies for the classes are furnished by T. E. B. at a nominal charge of $1 per member. Associations in 24 cities have started classes this year.

Cleveland, O.—The following firms had exhibits at the 19th annual meeting of the Natural Gas Association of America: Hotstream Heater Co., Cleveland; Corporation Sales Co., Cleveland; Borden Co., Warren, O.; Hays Manufacturing Co., Erie, Pa.; Bryant Heater & Mfg. Co., Cleveland, O.; Pittsburgh Water Heater Co., Pittsburgh, Pa.; and Voder-Thomas Mfg. Co., Cleveland, O.

Natonal Pipe and Supples Association's new officers, elected at the association's annual convention in Cleveland, O., May 22-23 are: President, W. E. Clow, Jr., James B. Clow & Sons, Chicago; first vice-president, M. W. Dennison, Braman, Dow & Co., Boston; second vice-president, W. C. Hanson, W. G. Schafer & Co., Washington; secretary-treasurer, George D. McIlvaine, 909 Oliver Building, Pittsburgh. Executive committee: J. J. McArdle, McArdle & Cooney, Inc., Philadelphia; Francis J. Baker, George H. Tay Co., San Francisco; Isidor Weil, Weil-McLain Co., Chicago; J. A. Vann, The Young & Vann Supply Co., Birmingham; G. H. Gorton, W. B. Young Supply Co., Kansas City; A. D. Taylor, McMann & Taylor Co., New York; H. W. Strong, The Strong, Carlisle & Hammond Co., Cleveland, and Murray W. Sales, Murray W. Sales Co., Detroit. Advisory board: L. C. Huesmann, Central Supply Co., Indianapolis; W. M. Pattison, The W. M. Pattison Supply Co., Cleveland, and Guilford R. Adams, Samuel Sloan & Co., Rochester, N. Y. The general optimism prevailing in the industry was reflected in the reports of satisfactory business conditions. The rapid growth of this organization, it was generally agreed, has made its meeting the major events of their kind in the wholesale heating and plumbing field.

National Association of Sheet Metal Contractors, at its twentieth annual convention, in Washington, D. C., June 17-20, was addressed at one of its sessions by E. B. Langenberg, who presented the

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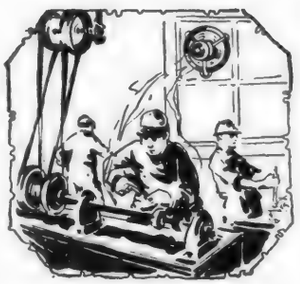

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report of the Warm-Air Furnace Committee, and by E. F. Glore, on "What the National Warm-Air Heating and Ventilating Association is Doing in Publicity Work."

Smoke Prevention Association, at its eighteenth annual convention in Buffalo, N. Y., June 3-5, was addressed, among others, by H. B. Meller, chief of the Pittsburgh Bureau of Smoke Regulation; Osborne Monnett, formerly of the Bureau of Mines, Washington, D. C.; John A. Talty, formerly with the New York State Public Service Commission; and L. B. Salt, of the B. F. Sturtevant Co., Boston. During the convention the members were guests of the Western New York Chapter of the American Society of Heating and Ventilating Engineers, at a dinner meeting at the Hotel Lafayette, Buffalo.

American engineers who attended the World Power Conference in London, June 30 to July 12, included Fred R. Low, president of the American Society of Mechanical Engineers and editor of *Power;* President William H. Baker of the Quigler Fuel Systems, Inc., New York; Harold V. Bozell, editor of the *Electrical World;* vice-president L. E. Conelly, of the D. Conelly Boiler Co., Cleveland; W. H. Easton, of the Westinghouse Electric & Mfg. Co.; A. C. Fieldner, supervising chemist of the U. S. Bureau of Mines; Dean E. A. Hitchcock, of the Engineering College, Ohio State University; D. S. Jacobus, advisory engineer, Babcock & Wilcox Co.; Professor Charles E. Lucke of Columbia University; president C. R. D. Meier, of the Heine Boiler Co.; George A. Orrok, consulting engineer, New York Edison Co.; secretary Calvin W. Rice of the American Society of Mechanical Engineers; Arthur L. Rice, editor of *Power Plant Engineering;* president R. Sanford Riley, of the Sanford Riley Stoker Co., and director George Otis Smith of the U. S. Geological Survey.

Manufacturers' Notes

American NoKol Co., Chicago, Ill., held its first convention at the Congress Hotel in Chicago recently when more than 150 dealers, representing as many cities in 41 states, were present. The company, which manufactures automatic oil heating equipment, entertained the visitors with a tour of the company's plant and a program of discussions of interest to the dealers.

William P. Bausmith, Cincinnati, O., has been named district sales representative for the McAlear Mfg. Co., Chicago, manufacturers of specialties for steam heating and power plants. Mr. Bausmith is located at 705 Gerke Building, Cincinnati.

Buffalo Forge Co., Buffalo, N. Y., and and its subsidiary companies, Buffalo Steam Pump Co., and Carrier Air Conditioning Co., held the annual meeting of its branch managers in Buffalo during the week of June 23. Thirty branch managers from different parts of the United States and Canada attended the conference.

A. W. O'Brien, Inc., 1 Hudson Street, New York, is the name of a new firm organized by A. W. O'Brien, formerly of Callahan, Kingsley Co., Inc. The new company will act as selling agents for manufacturers of heating equipment and now handles the Peerless Boilers, Riverside heaters and tanks, and Best registers and grilles.

Lewis F. Ostrander, vice-president and sales manager of the O-E Specialty Mfg. Co., Milwaukee, Wis., recently addressed the students in the Trade Extension High School at Los Angeles, where he was visiting the company's branch, on the subject of steam and vapor-vacuum heating. Mr. Ostrander visited the company's other branches in the west during his trip.

Buffalo Steam Pump Co., Buffalo, N. Y., recently installed a 6-in. three-stage, centrifugal boiler-feed pump to serve the boiler of the new Cecil plant of the Alleghany County Steam Heating Co., of Pittsburgh, Pa. The pump, its manufacturers say, when operating at a speed of 2,100 r. p. m., is capable of delivering 1,000 gal. of water per minute against 250 lbs. pressure.

Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., announces the construction of a new heating plant at its East Springfield works for the purpose of supplying steam for heating and manufacturing process. The new plant will contain four 500 H. P. Babcock and Wilcox boilers and will be

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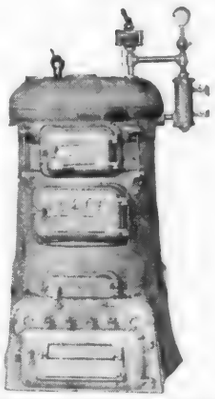
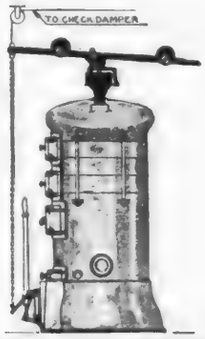
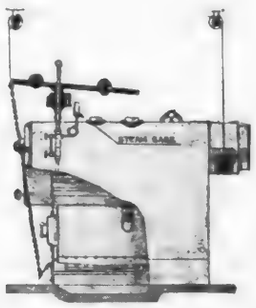


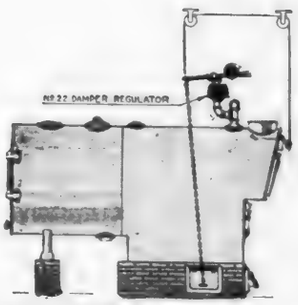
ABENDROTH BOILER



FLORAL CITY BOILER



SIMPLEX BOILER



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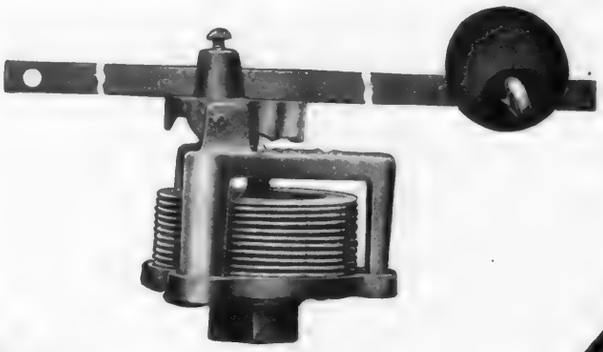
Damper Regulator



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equipped with the newest type of Westinghouse stokers, feeding from automatic coal-handling machines and discharging into automatic ash-handling machines. The company will transfer the manufacture of electric fans and fan motors to the East Springfield plant from Newark, so that the manufacture of meters at that plant can be extended.

Moore Steam Turbine Corporation, Wellsville, N. Y., has appointed M. D. Church, as genera manager. Mr. Church has been chief engineer of the Terry Steam Turbine Co., for the past 9 years.

Detroit Lubricator Co., has moved its New York office from 2709 Grand Central Terminal to 40 West Fortieth St.

De Laval Steam Turbine Co., Trenton, N. J., announces the formation of a Pacific Coast sales organization covering the States of California, Oregon and Washington, and parts of the adjoining states, under the direction of William Pullen, with offices in Los Angeles, San Francisco and Seattle. The Los Angeles district office is located at 312 Union Oil Building, 617 West Seventh Street, with Ivan E. Goodner in charge; the San Francisco district office, at 531 Rialto Building, Mission and New Montgomery Street, with Mr. Pullen in charge, assisted by Eck Baughn and Charles P. Markley; and the northwestern district office, in Seattle, Wash., at 1306-7 L. C. Smith Building, with James Q. Osborne in charge, assisted by F. A. Hurlbut.

"OUR BUILDING BOOM HEARD ROUND THE WORLD," is the way the *Trade Record* of the National City Bank of New York, describes the significant increases in the figures for importation of building materials, as compared with those of earlier years. These increases apply particularly to lumber, glass, steel structural shapes and building forms, while house furnishings, such as carpets, pottery, electric lamps, and art works, make an equally notable showing.

Central Station Heating Notes

Portland, Ore.—The use of waste material as fuel has resulted in a saving of 25% to 30% in the operation of tne central heating station at the University of Oregon. The new plant develops 650 H. P. and heats thirty campus buildings.

San Francisco, Cal.—The Great Western Power Co., has been authorized to increase its rates for steam heat in San Francisco 15 cents per thousand pounds, due to the advanced price of fuel-oil.

Portland, Ore.—L. T. Merwin, general manager of the Northwestern Electric Co., has announced that his company is unable to accommodate new requests for steam heat because of "too close supervision of the rates" to allow of any extension of the mains at the present time.

Lansing, Mich.—Plans have been approved by the city for the extension of the city's steam mains to take in the business territory between the river and the Pere Marquette railroad on East Michigan Avenue.

Illinois Power and Light Corporation, Chicago, Ill., has appointed Frank W. Bedard to a special field of endeavor created by the general offices of the company for the promotion of gas sales for industrial purposes and house heating. Mr. Bedard was until recently division manager of the company's properties at Champaign, Ill.

Contracts Awarded

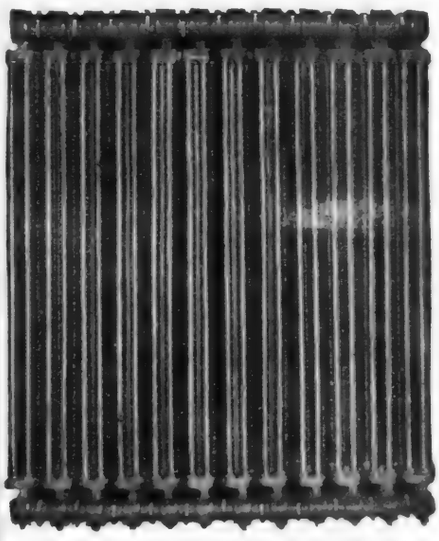
Moline Heating & Construction Co., Moline, Ia., heating and ventilating for the new Moline Elks Home at Moline, Ia., for $25,184.

New Incorporations

Silent Glow Oil Burner Corporation, West Hartford, Conn., capital $50,000, to engage in the manufacture of oil burners. Incorporators: James L. Bauer, Hartford, Conn., and others.

Newport Oil Burner Co., Newport, R. I., capital 5,00 shares, no par value, to manufacture oil burners for heaters. Incorporators: William P. Sheffield, J. K. Sullivan, William A. Peckham, William A. Sherman, and Frank P. Nolan, all of Newport.

Hot Blast Heating Perfected by the Lyon Interlocking Heaters



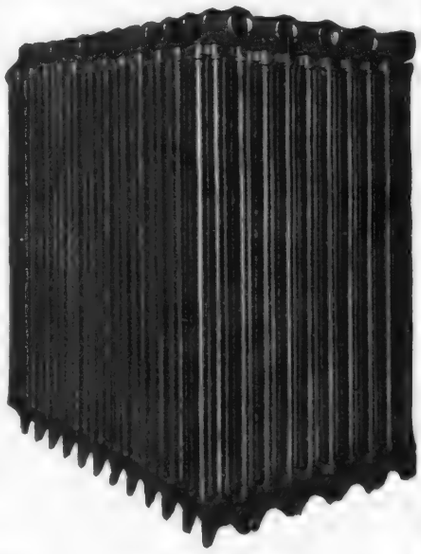
Their many superior features recommend them to the heating expert

The Lyon Interlocking Heaters are built in small sections of eight one inch pipes with Headers and Base, put together by Hydraulic pressure without threads. The Sections are assembled with exra heavy Right and Left Nipples. The Headers and Bases are made interlocking which allows for close assembling and the staggering of all pipes in the completed Heater.

Thousands of feet in daily use under pressure up to 100 lbs.

Some Territory Still Open to Reliable Agents

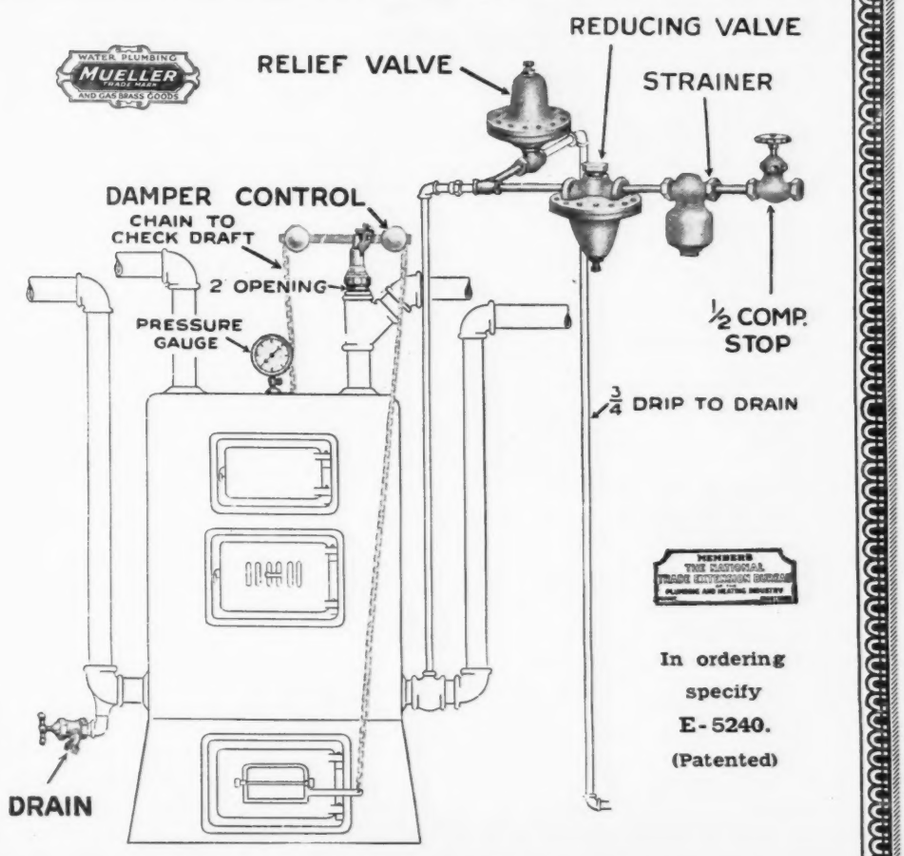
Send for descriptive circular and information regarding Heaters for all purposes



Front View These Heaters are made in the following sizes: *Back View*

Height	40″	50″	60″	70″	80″	90″	100″	110″	120″	130″	140″
Sq. Ft.	10.6	12.9	15.2	17.5	19.8	22.1	24.4	26.7	29.	31.3	33.6

LYON PRODUCTS COMPANY, Inc., *312-316 Union Park Court, CHICAGO, ILL.*



How to Stop Future Complaints

Complaints hurt any dealer. You can stop future complaints from your customers regarding their heating systems by selling and installing the

MUELLER

Automatic System of Hot Water Heat Control

It is shipped already assembled—has no useless and expensive expansion tank—operates on city water pressure—insures steady, even heat automatically.

Write us for detailed descriptions and prices, or order through your jobber.

Mueller Co., Decatur, Illinois, U. S. A.

145-149 W. 30th St., New York; 1072-76 Howard St., San Francisco; 2468 Hunter St., Los Angeles

NoKol Automatic Heating Corporation, Greensboro, N. C., capital $100,000. Incorporators: R. G. Sloan, F. L. Fry and B. H. Meland, all of Greensboro.

Super Oil Heater Co., Hartford, Conn., capital $250,000, to manufacture oil heating equipment. Incorporators: John C. Blackhall, John F. Brady and K. A. Brennan.

Warren Webster & Company's Convention

More than 100 members of the sales force and engineers of Warren Webster & Co., Camden, N. J. manufacturers of steam heating systems, feed-water heaters, and steam specialties, attended a company convention in Atlantic City in June.

Business and entertainment were pleasantly intermingled, the convention opening with a "get-together" dinner at the Bellevue-Stratford to which were invited also all department heads and factory foremen from the company's plant at Camden.

The following day the entire convention journeyed to Camden for an inspection of the company's new factory and main offices. A business session held in Camden was given over to a discussion of the Webster systems.

Other convention sessions were held in the Gold Room of the Hotel Chalfonte, while headquarters were maintained at Haddon Hall in Atlantic City. Sales and engineering problems were gone into at these business meetings while a circus, theatre party and golf tournament completed the entertainment program.

Many of those present for the convention, which continued from Tuesday to Saturday, remained over in Atlantic City for the meeting of the Heating & Piping Contractors' National Association convention, the following week.

Group of Sales Force and Engineers at Convention of Warren Webster & Company

Boston's Home Beautiful Show

Many manufacturers exhibited heating systems at the recent "Home Beautiful" show held in the Mechanic's Building in Boston. Among the exhibitors were:

Crane Co., Chicago; Magee Furnace Co., Boston; Sherman Oil Burner, Inc., Worcester, Mass.; Williamson Heater Co., South Boston; Richardson & Boyn-

MANUFACTURED WEATHER
makes
"Every day a good day"
Humidification · Dehumidification
Heating · Ventilation · Purification
Drying
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SEE OUR DETAILED DATA IN ASH&VE GUIDE
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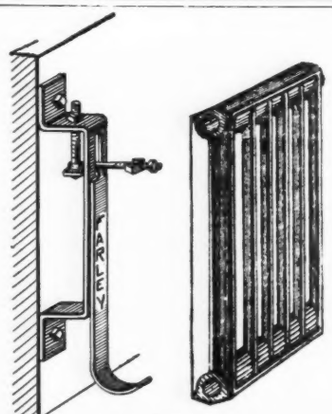
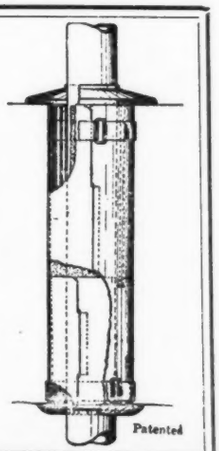


Patented

FARLEY
Hangers *and* Sleeves

This is the hanger you are looking for, made of hot rolled steel, will not break and made to fit any style of your radiation.

Fire resisting "Grab-on" sleeves are used in all classes of buildings. They are made to fit the condition of construction of the building. The only sleeve that will hold covering against the ceiling.



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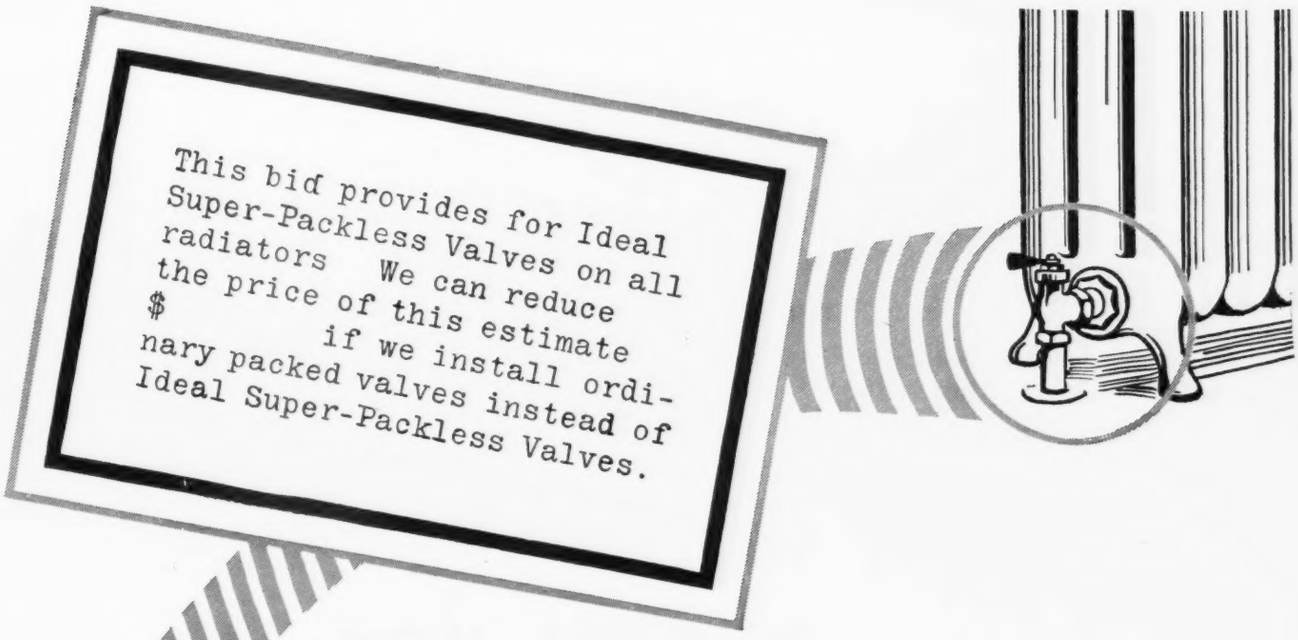
Send for descriptive literature

FARLEY SLEEVE AND HANGER COMPANY
3748 East 71st Street and Fleet Ave. Cleveland, Ohio


This bid provides for Ideal
Super-Packless Valves on all
radiators We can reduce
the price of this estimate
$ if we install ordi-
nary packed valves instead of
Ideal Super-Packless Valves.

This sticker made money for these contractors

RECENTLY we asked several Heating Contractors to try out the sticker shown above. For a short time each one agreed to paste this sticker on every heating bid.

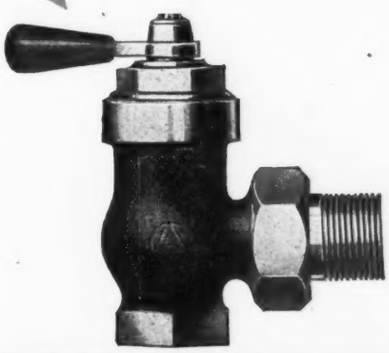
In a very short time five Heating Contractors reported sales of Ideal Super-Packless Valves and four of these sales are the direct result of using the stickers.

Here is a way to make money without one cent extra cost—a way to get owners to ask you to talk your bid after your competitors are all through.

Ideal Super-Packless Valves add the finishing touch to any installation for they make leaks impossible, they end the annoyance and expense of annual repacking and they open or close with one easy turn.

A postcard will bring you a stock of these "alternate bid" stickers and give you a chance to make this money, too.

(Stock No. 878)
For Steam, Water, Vacuum or Vapor jobs—old or new—large or small.



AMERICAN RADIATOR COMPANY
IDEAL Boilers and AMERICAN Radiators for every heating need
1807 Elmwood Ave. Dept. S Buffalo, N. Y.

IDEAL SUPER-PACKLESS Radiator Valves

ton Co., New York City; Vulcan Oil Burner Co., Boston; and the Weir Stove Co., Taunton, Mass.

Brunswick-Kroeschell Company's New Plant

The third annual sales convention of the Brunswick-Kroeschell Company, of Chicago, in its new plant, June 5-6, calls attention to the growth of this company which has necessitated the building of an entire new plant, at 4221 Diversey Avenue, Chicago. Many will remember the company as pioneers in the manufacture of air washing and cooling apparatus. The first air-cooling plant in Chicago, the company states, was a Brunswick-Kroeschell, installed in the Congress Hotel, in 1906. The company makes a specialty of this type of equipment, both for buildings, and, in marine work, for naval and merchant marine vessels. Recent notable installations of the company's equipment are those in the Chicago, Roosevelt and McVicker's Theatre, all in Chicago.

Another plant of the company in Brunswick, N. J. is given over altogether to the production of ammonia ice machines. About half of the new plant facilities are utilized for the production of carbonic ice machines, from one to 150 tons capacity, or even larger. The balance of production at the new plant is that of steel greenhouse boilers, high-pressure boilers of all types, breechings and stacks. The greenhouse boiler forms a specialized branch of the industry in which the company has been a factor from the start of this business. The boiler is designed to burn all kinds of fuel, including oil.

A total of 175,000 sq. ft. of space is provided in the new plant which is of brick and steel throughout. Oil is used as fuel for the plate furnaces and the rivet heaters, as well as for blacksmith forging. Hydraulic equipment is used for riveting and flanging, while all welding equipment is operated by electricity. The plant is also equipped with electric cranes.

An interesting practice followed by this company is the holding of educational meetings weekly by and for the employees. Subjects on refrigeration and boilers are presented by speakers in the form of elementary talks, and the meetings are attended by the members of all departments in the organization.

WANTED

Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.

POSITION WANTED—As Western sales manager, by heating and boiler man with over 15 years' successful experience in sales direction, promotion and advertising. Large acquaintance among architects, heating engineers and contractors. Fine references, Address Box 73, care of Heating and Ventilating Magazine.

POSITION WANTED—Heating and ventilating engineer, 29 years old, wishes a position with a leading firm of architects or engineers. Very experienced with mechanical ventilation and familiar with modern heating systems. Apply Box 74, care of Heating and Ventilating Magazine.

MANUFACTURERS' REPRESENTATIVE.—Experienced heating man, familiar with installation details of all types of heating systems, would like to represent manufacturer of heating specialties, preferably in the Boston district. Has been "on the job" and can talk the language of the trade. Address W. E. J., care of Heating and Ventilating Magazine.

Ventilation Sales Engineers.—$3000-$5000 salary, plus expenses; Central States. Client, manufacturing fans, blowers, ventilating apparatus, desires engineers having actual sales experience, or sales instinct and inclination, who have thorough knowledge of above equipment. Must be able to render service in the preparation of heating and ventilating system layouts from drawings, also to figure costs, prepare specifications. No drafting. Mr. Davis, William L. Fletcher, Inc., 93 Federal St., Boston, Mass.

AIR CONDITIONING TRADE MARK

APPARATUS for maintaining artificial atmospheric conditions in industrial plants.

ATMOSPHERIC CONDITIONING CORPORATION
LAFAYETTE BLDG.
PHILADELPHIA

Special Bargain Offer

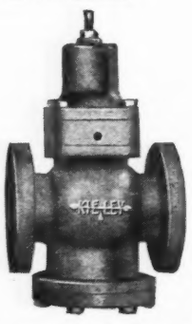
Limited number No. 4 SIROCCO FANS, new, in original package. Single inlet, full housed belted type, SKF self-aligning ball bearings.

Write us for full information and special offer to dealers and ventilating contractors.

REEVES MACHINERY COMPANY
75 E. Spring St., Columbus, O.

KIELEY
REGISTERED TRADE MARK

Steam, Water and Air Specialties



High Pressure Pilot Reducing Valve—300 lbs. to 10 lbs.

Manufacturers of the Complete Line

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Main Office and Works
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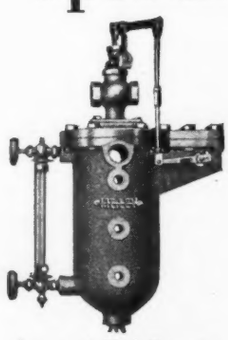

Automatic High Pressure Boiler Water Feeder